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DIVERGENT COLLABORATIONSM

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14. ABSTRACT Divergent Collaboration SM (DC) is a new approach to collaboration that uniquely harnesses the power of diversity. A series of DC workshops were designed and conducted by the Innovate, Demonstrate, Explore, Apply (IDEA) Lab at the Wright Brothers Institute (WBI) in tandem with a team of Human Factors researchers from the Human Effectiveness Directorate (RH) at the Air Force Research Laboratory (AFRL). The three DC workshops focused on the research challenges of Resiliency, Human Performance Augmentation (HPA), and Autonomy. Participants were asked to complete two assessments; the Dominance, Influence, Steadiness, and Compliance (DiSC) Personality Test and the Team Dimensions Questionnaire. Also, two questionnaires were developed that were administered after the workshops: 1) the DC process and 2) the products of the workshop. The Resiliency Workshop netted 24 ideas. The HPA Workshop resulted in 48 ideas. And finally, the Autonomy Workshop generated 35 ideas for research. Each workshop produced four (4) innovative/impactful ideas to research. These ideas are now in the hands of the problem owners to pursue them as they desire. Overall, it was determined that DC is a viable process that will foster innovation and create new ideas that might not be found using the traditional methods of solving problems.					
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1. EXECUTIVE SUMMARY

Divergent CollaborationSM (DC) is a new approach to collaboration that uniquely harnesses the power of diversity. It is a capability used to connect individuals from a wide spectrum of domains, backgrounds, and areas of expertise into the collaborative innovation process in order to explore a technology problem in a new way. A series of DC workshops were designed and conducted by the Innovate, Demonstrate, Explore, Apply (IDEA) Lab at the Wright Brothers Institute (WBI) in tandem with a team of Human Factors researchers from the Human Effectiveness Directorate (RH) at the Air Force Research Laboratory (AFRL). Together, these two groups of people formed the Executive Team for the DC project. The three DC workshops focused on the research challenges of Resiliency, Human Performance Augmentation (HPA), and Autonomy.

The workshop format was based on WBI Tec[^]Edge's diverge/converge paradigm in which people spend much of their time together diverging on ideas; exploring the problem space in different ways. This is followed by a converge activity in which all of the ideas generated during the diverge process are vetted and culled in an effort to hone in on the most relevant ideas for the specific problem the team is addressing. Each DC workshop lasted a day and a half and the total number of participants for each workshop ranged from 18-22 people. Based on the topic of the workshop, participants were chosen in fields adjacent to the area of interest. Prior to arrival, participants were asked to complete two assessments; the Dominance, Influence, Steadiness, and Compliance (DiSC) Personality Test and the Team Dimensions Questionnaire. Also, two questionnaires were developed that were administered after the workshops. One focused on the DC process and the other focused on the products of the workshop.

The next paragraphs review the results of these workshops from three perspectives: Process, products, and research. After reflecting on the three workshops, the Executive Team determined that the biggest lessons learned from the "process" perspective were: 1) trying to recruit people that could stay in the uncomfortable area of examining the problem space for longer than normal, and 2) determining how divergent the group should actually be.

In terms of products, the Resiliency Workshop netted 24 ideas of which 4 were determined to be innovative/impactful ideas to research first. The HPA Workshop resulted in 48 ideas of which 4 were thought to be innovative/impactful ideas. And finally, the Autonomy Workshop generated 35 ideas for research of which 4 were deemed innovative and impactful. These ideas are now in the hands of the problem owners to pursue them as they desire.

From the research perspective, the DiSC and Team Dimension assessments were reviewed by the Executive Team for each group of workshop participants. In terms of the Resiliency Workshop, participants were fairly evenly divided among three of the four Disc dimensions [there were zero participants in the fourth dimension] and all four of the four Team Dimensions. For the HPA Workshop, participants were fairly evenly divided among the four DiSC dimensions and the four Team Dimensions. However, for the Autonomy Workshop, the majority of participants fell into one category of DiSC and only one category for the

Team Dimension as well. Having this imbalance may have been the cause of some of the challenges that the Executive Team experienced when conducting the Autonomy Workshop. In the future, these assessments will be used prior to the workshop to better balance the workshop participants if possible or at least provide some information to balance the smaller team breakout sessions.

Overall, it was determined that DC is a viable process that will foster innovation and create new ideas that might not be found using the traditional methods of solving problems.

2. AN INTRODUCTION TO DIVERGENT COLLABORATIONSM

The idea of DC grew out of an informal discussion between the AFRL's Executive Director (Mr. Joe Sciabica) and a local artist (Mr. Peter Benkendorf) at a local coffee shop. They postulated about what might happen if technical people were infused with artistic people in problem solving activities. Then they put this idea into action.

The first activity that ensued was the Tech-Arts Pilot Project, a collaborative innovation experiment that RH and the IDEA Lab (teamed with Mr. Benkendorf) were engaged in throughout 2011. This project was an attempt to introduce some non-traditional thinking into RH's information visualization technology development activities by facilitating collaboration between a group of local artistic professionals and a team of scientists and engineers (S&Es) from RH as well as from AFRL's Sensors Directorate (AFRL/RV). From November 2010 to March 2011, these two groups met several times and facilitated brainstorming sessions were conducted around the topic of information visualization. These meetings produced a variety of innovative approaches to information visualization and resulted in several interesting follow-on projects between the artists and RH personnel. Overall, the combined artist/S&E team concluded that collaboration between professionals from these two different but related domains produced innovative ideas that should be further explored.

The next activity teamed students from Science, Technology, Engineering, and Mathematics (STEM) backgrounds with students from Stivers School for the Arts over the summer of 2011. This divergent group of students was tasked with portraying the mission and vision statements of one division in RH in an innovative and creative way in an effort to give more (non-technical) people a better understanding of the organization's work. Both technical and artistic knowledge was necessary for this project. This activity resulted in a number of innovative products.

Both of these activities were briefed to Mr. Sciabica, who encouraged members of the IDEA Lab to continue to pursue formalizing the process so it could be used for future activities in an effort to spur innovation and creativity when addressing current AFRL challenges. The director of RH, Mr. Jack Blackhurst, defined three key areas for the DC process to be applied - Resiliency, HPA, and Autonomy. These three areas were chosen because of their importance, complexity, and needed innovation. He also identified three "problem owners" to engage with during the workshop design and execution. An Executive Team was formed consisting of people from the IDEA Lab and the RH's Warfighter Interface Division. Also, a process consultant was added to the group shortly thereafter. The mission of the team was twofold: 1) to establish a DC process that would harness the power of combining people from different perspectives to address relevant challenges, and 2) apply that process to three current challenging areas in the Directorate, refining the process as needed. The objectives for the members of the Executive team varied. The IDEA Lab participants wanted to define and refine the DC process so they could add it to the services they offer AFRL researchers to facilitate in strategic planning and problem solving activities. The RH participants were interested in looking at the process and the participants from a research perspective, seeing how the characteristics of the participants impacted the process. All members of the Executive team wanted to produce products useful to the problem owners.

3. THE DIVERGENT COLLABORATIONSM PROCESS

The DC Executive Team consisted of Dr. Bart Barthelemy and Ms. Candace Treasure of the IDEA Lab; Dr. Scott Galster, Dr. Kristen Liggett and 2Lt Rachael Bryson of the Warfighter Interface Division, Human Effectiveness Directorate. Also, Kathy Hollingsworth, a process consultant, was added to the group to help guide the Executive Team in workshop design and structure. Appendix A contains short biographies of the Executive Team members.

This team conducted a careful examination in the following areas: current innovation processes being employed, potential surveys and assessments for participant characterization, metrics to measure the quantitative and qualitative aspects of the process, as well as other applicable research tools and techniques. The Executive Team worked collaboratively to design the DC process, which took approximately 3 months. Activities during this time fell into two categories. The first involved selecting participants; the second involved designing workshop activities.

3.1. Participants

3.1.1. Selecting Participants

One of the most important steps in DC is selecting participants. The process that the Executive Team utilized started by brainstorming professions and/or areas of expertise that were adjacent but related in some way to the challenge areas (Resiliency, HPA, and Autonomy). For example, AFRL is interested in determining what makes a human/machine team effective because there are current challenges facing remotely piloted aircraft operators and the semi-autonomous vehicles they operate. These challenges may be analogous to the challenges a surgeon faces when teamed with a robot to perform surgery. Next, the Executive Team went through an objective ranking process to decide which career areas were most important to include in the workshop. The Executive Team then identified individuals that fit into each area, either through personal connections, professional networks and associations, or internet searches. These professionals were then sent an invitation to attend that included a flyer highlighting the DC process, the IDEA Lab, and the facilitators leading the effort. Appendix B contains a copy of a DC workshop invitation.

3.1.2. Assessing Participants

To help the Executive Team better understand the participants for each workshop, two assessments were administered prior to the workshops. These included Inscape Publishing's DiSC Classic Profile and Team Dimensions 2.0 Profile. The DiSC measures personality and behavioral style; Team Dimensions measures a person's most natural team role. These assessments were intended to be used post-workshop to characterize the participants in terms of their communication and team dynamic styles in an effort to compare the participants' attributes to workshop execution and products.

3.2. Workshop

3.2.1. Workshop Model

Central to DC is the IDEA Lab's Collaborative Innovation Process (Figure 1). The Executive Team used this process as a model for developing the DC process. They also leveraged the Tech-Art Pilot Project, however, Tech-Arts was a three month activity and the goal for the DC workshops was a more time-condensed workshop. The biggest (and most time-consuming) challenge for the Executive Team was converting this model into a series of meaningful and relevant workshop activities to harness the power of the model. The executive team met regularly to design and construct the overall DC process, as well as a tailored workshop for each challenge area.

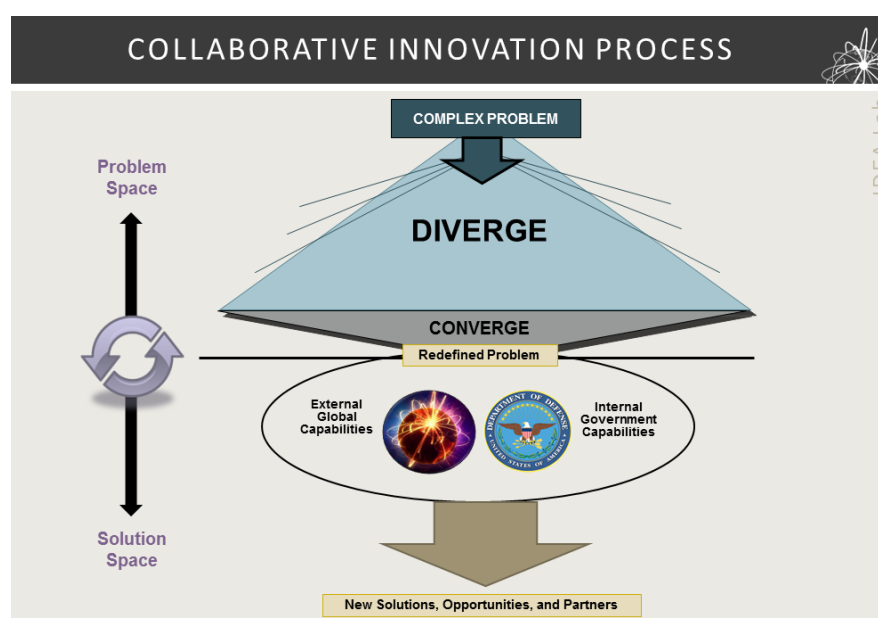


Figure 1. IDEA Lab's Collaborative Innovation Process

3.2.2. Workshop Activities

Although the main activities in the workshop were focused on divergent thinking, there was also a need to include trust-building activities and group events. Each DC Workshop was a day-and-a-half event and activities varied slightly based on the challenge to be addressed. The activities were specifically designed to explore the problem space of the identified challenge in new and different ways. The workshop activities were comprised of three primary categories: trust building, diverging, and converging.

3.2.2.1. Trust Building

One of the factors that the Executive Team believed contributed to the overarching success of the Tech-Arts Pilot Project was the amount of time spent establishing trust and building relationships between the two communities of artists and engineers. Similarly, taking the time to establish trust among an even more diverse group of participants was a critical

component in the design of the DC workshops. Trust building included activities to get to know one another through various introduction methods (Two Truths and a Lie, Introducing each other, etc.), an exercise to show the interrelatedness of the group, asking participants to explain why they thought they were invited to the workshop and what they could contribute, establishing a high-level definition of the challenge area (Resiliency, HPA, and Autonomy), participating in an exercise called Zoom/Re-Zoom to facilitate appreciation for other perspective and problem solving skills, and a mandatory social hour for networking.

3.2.2.2. Diverging

Following the *Diverge/Converge* model (Figure 1), the Diverge section was comprised of various brainstorming exercises to get participants to expand and extend their thinking in multiple, lateral, and different directions. These activities were conducted through facilitated brainstorming in small group break-out sessions, which were then presented back to the larger group. Participants were exposed to the problem at a high, surface level, without the application, context, and background of the particular Air Force problem or need.

3.2.2.3. Converging

Once participants thoroughly explored the problem space through the diverging exercises, they were then exposed to the actual Air Force, or AFRL problem and context. This transition was coined by the Executive Team as the *lens-shift*, and served to focus the group on the actual problem at hand. Again, through facilitated break-out groups and large group exercises, the participants generated new ideas and also discussed, defined, and refined ideas into insights that might influence and invigorate new and existing research in AFRL. These ideas and insights, the product output of a workshop, also included new directions and opportunities for AFRL to explore further.

3.2.3. Measuring the Effectiveness of the Workshop

To help the Executive Team determine which metrics to utilize in assessing the effectiveness and success of the DC workshops, the team consulted Matt Valenti, Deputy Corporate Development Officer for AFRL, in the preliminary stages of this effort. Measurements in the form of surveys and questionnaires, centered on two primary areas: (1) the DC process, and (2) the products of the workshops. The Process Questionnaire was taken by all participants, problem owners, and Executive Team members. This survey centered on understanding the effectiveness of the structure, design, and process utilized throughout the workshop, as well as to identify any areas of improvement. The Product Questionnaire was given to the problem owners and the Executive Team to assess the output of the workshop including the level of innovation and creativity.

3.2.4. Vetting the DC Process to the Problem Owner

The next step in the planning phase was to contact the designated AFRL problem owners. These people were managers or researchers working in the technical areas of Resiliency, HPA, or Autonomy. The Executive Team met with the problem owners to introduce them to the DC process and to clarify expectations. Engagement with them in the development and

pre-workshop planning phase was designed to be minimal so that they could attend the workshop as participants – objective and unbiased in exploring the problem in a new way.

4. DIVERGENT COLLABORATIONSM IN ACTION

This section will highlight the details of the three DC workshops that were conducted.

4.1. The Resiliency Workshop

4.1.1. Resiliency Challenge Statement

Every day the men and women in our armed forces are placed in highly stressful situations, and we are looking at ways of mitigating the pressure placed upon them by exploring Resiliency.

4.1.2. Resiliency Workshop Participants

After considering approximately 65 individuals with backgrounds in over 30 different areas of interest, the Executive Team ultimately chose twelve collaborators to attend the Resiliency Workshop. Their backgrounds included the following:

- Life Coach; Motivational Speaker
- Military Counselor
- Division I College Football Player; Local Community Center Director
- Personal Trainer; Physiologist
- Spiritual Advisor; Marianist Brother; Business Ethics Professor
- Emergency Room Doctor; Emergency Management
- Alternative Medicine Therapist
- Life Coach
- Marine
- Hospital Administrator
- Physical, Occupational, and Speech Therapist
- Qi Gong/Tai Kwon Do Instructor

Additional participant demographic information can be found in Appendix C.

Figure 2 shows participant information from the DiSC and Team Dimensions Profiles administered pre-workshop.

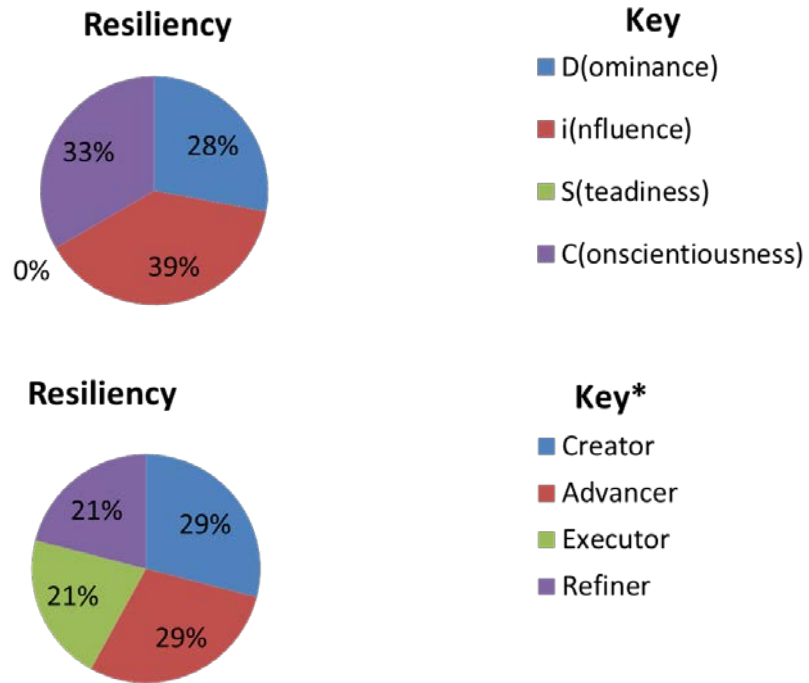


Figure 2. DiSC and Team Dimension Summary for Resiliency Participants

4.1.3. Resiliency Agenda

Day 1

Time	Event
12:00-12:15	Arrival and Check-In
12:15-1:15	Working Lunch – Introduction of Participants
1:15-2:15	Defining Resiliency (Participants)
2:15-2:30	Break
2:30-3:30	Connecting the Dots
3:30-4:00	Overview of DC; Resiliency (Executive Team)
4:00-4:15	Break
4:15-5:45	Diverge Activity: Metaphoric Thinking
5:45-6:30	Social Hour

Day 2

Time	Event
8:00-8:30	Check-in & Breakfast
8:30-8:45	Previous Day Recap
8:45-9:30	Diverge Activity: Build A Life
9:30-9:45	Break
9:45-11:45	Diverge Activity: Show and Tell
11:45-1:00	Lunch
1:00-3:00	Converge Activity
3:00-3:15	Break
3:15-4:00	Admin (Questionnaire Completion)
4:00-5:00	Closing Recap

4.1.4. Resiliency Products

Appendix D contains the comprehensive list of ideas generated by the Resiliency group. Listed below is a summary of the most innovative or most impactful ideas on the Resiliency challenge according to the Executive Team:

1. Continuity of Care – providing warfighters with care, support, and assistance prior to deployment, during deployment, and after deployment.
2. Institute Peer Mentors – someone who has “been there, done that”, rather than military chaplains or psychologists that not only carry a stigma but are also perceived to be disconnected to warfighter experiences.
3. Take a holistic approach to care – take into consideration all aspects of an individual’s life as opposed to simply their mental state. This might include spiritual, emotional, physical, occupational, social, as well as mental considerations.
4. Validation of the problem owner’s conclusions on solution opportunities to further explore in Resiliency. Overall the Resiliency problem owners felt that the divergent collaborators came to similar conclusions as their team had prior to the Divergent CollaborationSM workshop. This validation, that the insights and ideas generated by an independent and objective group aligned with their own, was just as powerful and valuable to the problem owners as were brand new ideas and approaches to the problem.

4.1.5. Resiliency Workshop Assessments

4.1.5.1. Process Assessments

Graphs summarizing the responses on the Resiliency Process Questionnaire can be found in Appendix E. Overall, participants in the workshop had positive comments about the DC process. Activities that participants liked the most were the break-out sessions that focused on the diverge/converge activities. Interestingly, the activities that participants valued the least were the team building exercises (Questions 9, 12, and 30). In terms of the divergence of the group (Question 18) no one thought there were people in the group with specializations very similar to their own. Finally, participants were satisfied with their experience and would overwhelmingly participate in similar projects in the future (Questions 26, 27, and 31).

4.1.5.2. Product Assessments

Graphs summarizing the responses on the Resiliency Product Questionnaire can be found in Appendix F. Areas where the problem owners and the Executive Team differed on responses addressed the uniqueness of the products (Question 4) and the ability to generate the same results without the diverse group of participants (Question 6). These differences can be attributed to the information in Item 4 in the Product section, in which the problem owners thought that the DC workshop validated ideas they had already come up with previously.

4.2. The Human Performance Augmentation (HPA) Workshop

4.2.1. HPA Challenge Statement

How can we enhance or augment the performance of human beings?

4.2.2. HPA Workshop Participants

The Executive Team evaluated over 100 individuals with backgrounds in approximately 80 different career areas of interest. The team ultimately chose people in the following 12 areas to attend the workshop:

- Human Cycle Optimization Specialist
- Personal Trainer
- Navy Seal; Spy Trainer
- Special Education Teacher
- Chief Executive Officer of a Production and Machining Company
- Naturopathic Doctor
- Cardiac Surgeon

- College Admissions
- University Cross-Country Coach
- Philharmonic Orchestra Conductor
- Business Strategy Consultant and Professor

Additional participant demographic information can be found in Appendix G.

Figure 3 shows participant information from the DiSC and Team Dimensions Profiles administered pre-workshop.

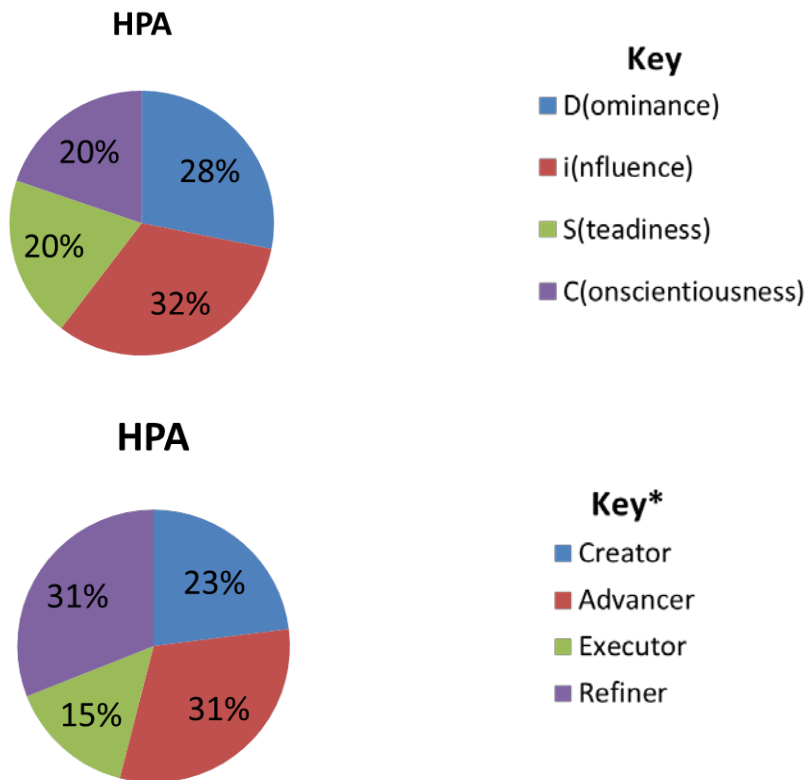


Figure 3. DiSC and Team Dimension Summary for HPA Participants

4.2.3. HPA Agenda

Day 1

Time	Event
12:00-12:15	Arrival and Check-In
12:15-1:15	Working Lunch – Introduction of Participants
1:15-2:15	Defining HPA (Participants)
2:15-2:30	Break
2:30-3:30	Connecting the Dots
3:30-4:00	Overview of DC; HPA (Executive Team)
4:00-4:15	Break
4:15-5:00	Diverge: Metaphoric/Free Association
5:00-5:45	Report Out & Homework
5:45-6:30	Social hour

Day 2

Time	Event
8:00-8:30	Check-in & Breakfast
8:30-8:45	Previous Day Recap
8:45-9:30	Zoom/Re-Zoom Activity
9:30-9:45	Break
9:45-10:45	Diverge Activity: Application to the HUMAN (3 groups)
10:45-11:45	Report Out
11:45-12:00	AFRL HPA Lens Shift (the problem/context within AFRL)
12:00-1:00	Lunch
1:00-3:00	Converge Activity: Categorization (1 group)

	Application to Human/AF
3:00-3:15	Break
3:15-4:00	Admin (Questionnaire Completion)
4:00-5:00	Closing Recap

4.2.4. HPA Products

Appendix H contains the comprehensive list of ideas generated by the HPA group. Listed below is a summary of the most innovative or most impactful ideas on the HPA challenge according to the Executive Team:

1. Research to increase integrated augmentation approaches, amalgamating both traditional and non-traditional methods.
2. Explore the use and effect of non-traditional augmentation on performance, e.g. auras, acupuncture, etc.
3. Vary environmental factors, including tonal changes to maintain alertness as well as the effects of light on performance.
4. Implement intentional distractions to keep people focused and alert .

4.2.5. HPA Workshop Assessments

4.2.5.1. Process Assessments

Graphs summarizing the responses on the HPA Process Questionnaire can be found in Appendix I. Overall, participants overwhelmingly liked the trust building activity called Zoom/Re-Zoom and the diverge activity that focused on metaphoric thinking and free association (Question 30). Also, about 70% of the participants felt that the group was diverse in terms of their area of specialization (Question 18). Finally, participants were satisfied with their experience and would participate in similar projects in the future (Questions 26, 27, and 31).

4.2.5.2. Product Assessments

Graphs summarizing the responses on the HPA Product Questionnaire can be found in Appendix J. Again, the problem owners were not convinced that they would not have achieved the same or similar results without the DC workshop (Question 6), however, they did agree that new research ideas were generated from the workshop (Question 3) and that there was value in the divergent part of the process (Question 7). Also, their overall impression of the workshop was positive (Question 14).

4.3. The Autonomy Workshop

4.3.1. Autonomy Challenge Statement

How can machines seamlessly integrate with humans to maximize performance in highly complex and/or high-risk environments? Examples include systems that require human supervision of automated operations, such as robotic manufacturing, remotely piloted aircraft, and automated flight deck operations.

4.3.2. Autonomy Workshop Participants

After considering over 90 individuals from more than 50 potential career areas for the Autonomy Workshop, the Executive Team ultimately selected 13 ideal candidates to attend the event. The backgrounds of the chosen participants include:

- Investment Manager and Certified Financial Accountant
- Warfighter
- Robotic Surgeon
- Peace Corps Member
- Astronaut
- Owner of Heavy Construction Company
- Expert in Human-System Interfaces
- Pilot
- Remotely Piloted Aircraft Operator
- Science, Technology, Engineering, and Mathematics Educator; Instructional Designer
- Sensors and Cognitive Systems Researcher
- Entrepreneur
- Generational Expert and Strategist

Additional participant demographic information can be found in Appendix K.

Figure 4 shows participant information from the DiSC and Team Dimensions Profiles administered pre-workshop.

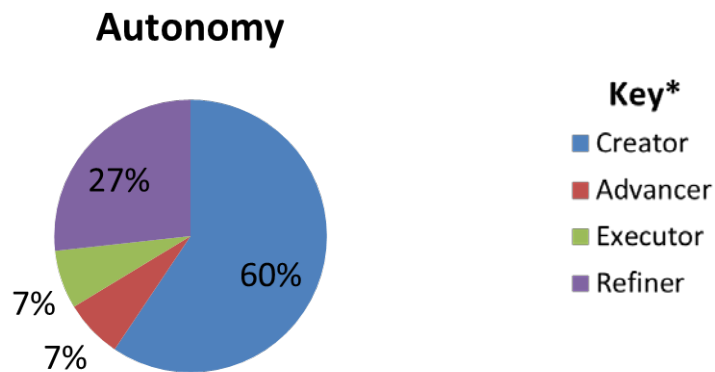
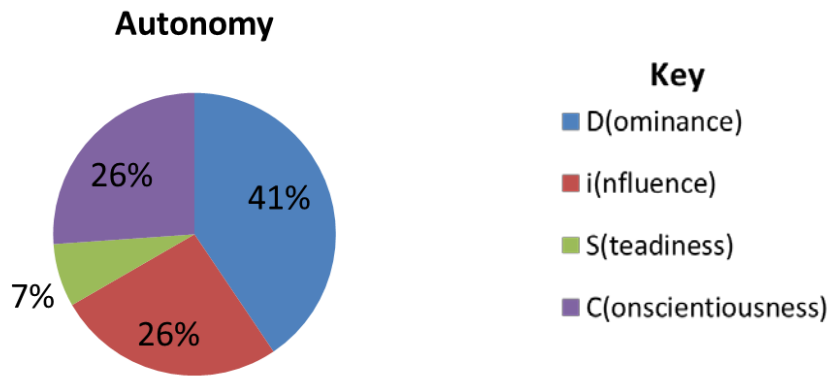


Figure 4. DiSC and Team Dimension Summary for Autonomy Participants

4.3.3. Autonomy Agenda

Day 1

Time	Event
8:00-8:30	Arrival and Check-In
8:30-9:30	Introduction of Participants
9:30-10:30	Defining Human-Machine Teaming in Autonomous Systems (Participants)
10:30-10:45	Break
10:45-11:45	Connecting the Dots
11:45-12:45	Lunch & DC Overview (Executive Team)
12:45-1:30	Zoom/Re-zoom Activity

1:30-2:35	Diverge Activity: Break-Out Session
2:35-2:50	Break
2:50-3:20	Diverge Activity: Break-Out Session Continued
3:30-4:30	Report Out and Discussion
4:30-5:30	AFRL Autonomy Lens Shift (the Problem/Context within AFRL)
5:30-6:30	Social hour

Day 2

Time	Event
8:00-8:30	Check-In & Breakfast
8:30-9:30	Previous Day Recap and Homework Review
9:30-10:10	Converge Activity Part I
10:10-10:50	Converge Activity Part I: Report out
10:50-11:05	Break
11:05-12:05	Converge Activity Part II: Research themes
12:05-12:20	Admin (Questionnaire Completion)
12:20-12:30	Closing Recap

4.3.4. Autonomy Products

Appendix L contains the comprehensive list of ideas generated by the Autonomy group. Listed below is a summary of the most innovative or most impactful ideas on the Autonomy challenge according to the Executive Team:

1. Research generational differences. In particular, how different generations accept and utilize technology changes and greater automation, and tailor training and implementation of increased autonomy so that it takes into account these considerations.
2. Utilize a cafeteria-style use structure of autonomy. That is, enable users to pick and choose when and where to use autonomy as well as the level of automation.

3. Managing autonomy doing things beyond human control. Implement greater automation to extend normal human capabilities or to perform beyond normal capabilities.

4.3.5. Autonomy Workshop Assessments

4.3.5.1. Process Assessments

Graphs summarizing the responses on the Autonomy Process Questionnaire can be found in Appendix M. Unlike the previous two workshops, participants in the Autonomy Workshop had varying opinions on many of the questions. For instance, some people did not think that everyone participated in the group discussions (Question 4) and felt constrained to only pursue certain types of ideas (Question 5). Most people thought the level of structure of the workshop was just right, however, some thought it was too little and even more thought it was too much (Question 14). Another area of disagreement was whether the facilitators answered questions effectively during the workshop (Question 17). Also, many participants (~45%) thought that the knowledge and experience of the group was insufficient to explore the problem (Question 20). Finally, this was the first time that any participants were dissatisfied with their experience (Question 26) but all agreed that they would like to participate in similar projects in the future (Question 27).

4.3.5.2. Product Assessments

Graphs summarizing the responses on the Autonomy Product Questionnaire can be found in Appendix N. In summary, the problem owners did not think any new research ideas or areas of investment were uncovered from the workshop (Question 3 and 5). The problem owners thought that perhaps this occurred because the topic was too broad (Question 14).

5. DISCUSSION

This section contains a discussion of the DC workshops in terms of the process, products, and research.

5.1. DC Process

5.1.1. Workshop Timing

In terms of the length of the workshops, 1 and ½ days seemed to be optimal. It was a reasonable amount of time for the participants to commit to this activity and an adequate amount of time to conduct the workshop activities effectively. For the first two workshops, a ½ day session was followed by a full day. For the third workshop, a full day was followed by a ½ day session. Based on Executive Team feedback, there was a clear advantage of having the ½ day session first, followed by a full day session.

For the Resiliency and HPA Workshops, the first ½ day included team/trust building, introducing the problem in general terms, and then engaging in the first diverge activity. Since diverging is sometimes uncomfortable for people, it seemed reasonable to conduct one diverge activity on the first day and then finish up with a social hour. On the second (full) day for the Resiliency Workshop, another diverge activity was conducted before converging and then wrapping up. The second (full) day for the HPA Workshop was a little different because of the feedback that the Executive Team received from participants in the Resiliency Workshop. During the Resiliency Workshop, the Executive Team tried very hard to keep the discussion on resiliency in general terms and not talk about the Air Force specific resiliency challenge because they thought it would bound the discussions and inhibit the “out-of-the-box” thinking they wanted participants to engage in. They wanted people to talk openly about their unique perspectives on the general problem. When specific examples were brought up (i.e., the suicide rate of deployed military members) the Executive Team tried to bring the discussion back to a more general discussion. This, however, caused many participants angst because they knew they were brought together by the Air Force to “help” and they wanted to ensure their inputs were relevant to the specific Air Force problem that brought them together. As a result, the Executive Team decided that they should present the focus area of the subsequent workshops in an Air Force context sometime later in the workshop so as not to constrain initial discussions but to provide that context for the participants. The Executive Team added a session in the HPA and Autonomy Workshops to address this and called it the AFRL lens shift. During the HPA Workshop, the second day started with a team building exercise followed by another diverge activity and then the lens shift before lunch. After lunch, the group participated in a converge activity and then wrapped up. This order of events was very effective.

For the Autonomy Workshop, due to scheduling conflicts with the Executive Team and participants, the first day of the workshop was a full day followed by a ½ day on the second day. Because of this, the first day contained team building activities, and two diverge activities followed by the lens shift at the end of the day. Unfortunately, this sequence of events or the timing of these events impacted the second day significantly. Perhaps

because participants had spent most of the day in the uncomfortable area of exploring the problem space without moving to solutions and then they were presented with a very specific problem during the lens shift, they wanted to focus on problem solving the next day. Perhaps because they had the evening to think about the day's activities and the last thing they heard was the lens shift, they became focused on solving the specific problem presented in the lens shift for the next day. Whatever the cause, the participants could not focus on anything but trying to solve the Air Force specific problem presented at the end of Day 1. The Executive Team spent more time than usual encouraging the participants to engage in the prescribed activities and explaining the process in different ways to help them better understand the objectives of the process. Even after ad hoc discussions on the purpose of the DC process, the majority of participants were disinclined to participate in anything other than problem solving. While the enthusiasm and energy they exhibited in focusing on solutions was admirable, the workshop was not designed to solve the problem. This circumstance somewhat derailed the second day of the Autonomy Workshop.

5.1.2. Network of Participants

Another process challenge was identifying participants in adjacent fields to the workshop focus area. As was mentioned in Section 3.1.1 participants were selected via personal connections, professional networks and associations, or internet searches. The advantage of the first two methods was that knowing the participants gave the Executive Team a better feel for how well the person would thrive in this type of workshop and how comfortable the person might be staying in the problem space. As a matter of fact, the Executive Team determined that this factor was most important for the success of the workshops. So if the potential participants are unknown, it might be risky to recruit them. Even the pre-workshop assessments did not give a good indication of how effective people would be in this capacity. But if selecting participants depends on relying only on people the Executive Team knows personally, this narrows the participant pool significantly.

Another point to consider when selecting participants is how diverse to make the group. As was mentioned, people were selected in fields adjacent to the area of interest so the level of "diversity" was somewhat constrained by the Executive Team's process for selecting participants. However, for an initial trial of the process, this seemed like a reasonable approach.

To help mitigate these challenges for future DC workshops, the Executive Team would like to establish a network of participants by gathering contacts over time from previous workshop participants, WBL employees as well as AFRL contacts.

5.1.3. Problem Owners

A third process discussion point is the role of the problem owner. As was mentioned earlier, the RH Director selected three areas to investigate with the DC process. He also selected problem owners to serve as liaisons between the Executive Team and researchers at AFRL, working in the areas of Resiliency, HPA, and Autonomy. A potentially better scenario would have been if the problem owners initiated the interaction with the IDEA Lab and proactively sought out the use of the DC process to help them with their research challenge. That's not

to say that the problem owners that were identified for these three workshops did not engage in any of the planning activities; however, since their involvement was directed, it was minimal. If, in the future, problem owners are the catalyst for a DC workshop, their level of involvement would certainly be higher as would the chance for products to transition.

5.2. DC Products

All three DC workshops generated products. The top ones for each workshop are restated here:

- Resiliency Workshop
 - Continuity of care
 - Institute peer mentors
 - Take a holistic approach to care
 - Validation of the problem owner's conclusions
- Human Performance Augmentation Workshop
 - Integrated augmentation approaches (traditional and non-traditional)
 - Non-traditional (auras, acupuncture, etc.)
 - Vary environmental factors
 - Intentional distractions
- Autonomy Workshop
 - Generational differences
 - Cafeteria-style usage structure
 - Managing autonomy doing things beyond human control

Although the Autonomy Workshop got a little off track, the ideas listed directly above are the products from the workshop. Of particular interest was the idea of investigating the effects of multiple generations on the design, development, and deployment of autonomous systems. For instance, people in the Millennial Generation will be the future operators of heavily automated systems and will probably be very comfortable doing so, but the researchers determining the optimum level of automation between the human and the system are from Generation X and they have a different perspective on autonomous systems. Further, the generals in charge of allowing that type of system to operate in a future combat environment are from the Baby Boomer Generation with yet a third perspective on the employment of autonomous systems. Considering each generation and their approaches and perspectives on interacting with automation may play a significant role in effectively integrating and employing this type of technology in the future. This unique perspective on the generational challenges of designing and employing an autonomous system was brought to light because one of the participants of the Autonomy Workshop was a Generational Expert and Strategist. Many of the other participants acknowledged that they were unaware of this factor when considering the autonomy challenge. This idea for

research, as well as all others, are now in the hands of the problem owners to pursue them as they desire.

5.3. DC Research

The members of the Executive Team from RH were interested in seeing how the personalities of the participants as well as their interaction style might impact the process and products of the workshop. The pie charts in Sections 4.1.2, 4.2.2, and 4.3.2 show the distribution of participants in all three workshops based on the two assessments administered prior to the workshops (the DiSC and Team Dimension assessments). In terms of the Resiliency Workshop participants, they were fairly evenly divided among three of the four DiSC dimensions [there were zero participants in the fourth dimension] and all four of the four Team Dimensions. For the HPA Workshop participants, the group was fairly evenly divided among the four DiSC dimensions and the four Team Dimensions. However, for the Autonomy Workshop participants, the majority of participants fell into the Dominance category of DiSC and the Creator category for the Team Dimension. Having this imbalance may have been the cause of some of the challenges that the Executive Team experienced when conducting the Autonomy Workshop.

Since the characteristics of the participants may have had an effect on the workshops, perhaps these assessments can be used to screen participants in the future or to, at a minimum, balance break-out groups to enhance the interaction of the participants.

6. CONCLUSIONS

The value of bringing together groups of people with diverse backgrounds and experiences to examine problems and solutions in an innovative way was demonstrated with the development and implementation of the Divergent CollaborationSM process. Although there were challenges in developing the process and executing the workshops, many interesting ideas were generated and the lessons learned by participating in and evaluating the feedback will be incorporated to make the process even more effective for future DC workshops.

7. APPENDICES

7.1. Appendix A – Executive Team Biographies

Bart Barthelemy is the Founding Director of the Wright Brothers Institute (WBI) and the current Director of WBI's IDEA Lab, where he is responsible for providing innovative solutions to critical problems in science, technology and R&D. He is a nationally known consultant, facilitator and trainer and specializes in leadership, as well as innovation and collaboration for academia, government, and Fortune 500 companies. Dr. Barthelemy has a Bachelor of Science in Chemical Engineering and Polymer Science from MIT; a Master of Science in Nuclear Engineering and Physics from MIT, and a Doctor of Philosophy in Nuclear Physics/Mechanical Engineering from The Ohio State University.

Candace Treasure is the Innovation Program Manager at the Wright Brothers Institute's IDEA Lab. Utilizing leading-edge innovation techniques and tools, Candace plans and executes major collaborative innovation programs to help solve complex challenges in the defense, science and technology, and R&D industries. She holds a Master's degree in Business Administration with a Bachelor's in International Business and Spanish, both from the University of Dayton.

Scott Galster, PhD, is the Chief of the Applied Adaptive Aiding Section in the Applied Neuroscience Branch, 711 Human Performance Wing at Wright-Patterson Air Force Base. Scott leads the Applied Neuroscience sub-Core Technology Competency area and is accountable for strategic planning, development, execution and reporting of a diverse body of neuroscience-based research and development efforts. Scott holds a PhD in Applied Experimental Psychology.

Kristen Liggett is a Senior Human Factors Engineer in the Battlespace Visualization Branch of the Human Effectiveness Directorate where she leads a multi-disciplinary team of researchers addressing the challenging area of information overload in cyber operations and how visualizations can help alleviate this situation. Kristen received her BS in Human Factors Engineering in 1989, a MS in Engineering Management in 1994, and a PhD in Engineering in 2000. Through her 26 years working for the government, Kristen has seen the value of bringing a diverse group of people together to solve complex problems and has been involved with Divergent CollaborationSM since its inception.

2d Lt Rachael Bryson is in the Applied Neuroscience Branch of the 711 Human Performance Wing at Wright-Patterson Air Force Base. Rachael leads the Applied Neuroscience Cyber Research and Development effort. She is responsible for strategic planning, development, execution and reporting of a diverse body of research and development efforts examining the applied neuroscience aspects of decision making in cyber, ISR, and RPA domains. She has a Bachelor of Arts in Psychology and Studio Art and a minor in Middle Eastern Migrations and Communities, all from James Madison University.

Kathy Hollingsworth is dedicated to helping others reach their potential by understanding their worth using iiChange[®] skills and tools to enrich their lives. Prior to starting Innovative InterChange[®] Inc., she spent twenty-nine years in banking, including several years as

president and CEO of National City Bank, Southwest. She earned a bachelor's degree in geography from Wittenberg University and an MBA from Case Western University.

7.2. Appendix B – Invitation to Participants

Dear [name of invitee]:

The IDEA Lab at the Wright Brothers Institute, Dayton, OH, in conjunction with a team from the Air Force Research Laboratory (AFRL) at Wright-Patterson Air Force Base, has created a unique approach to help achieve breakthroughs in solving complex problems. This process, known as Divergent CollaborationSM, takes place during a two-day workshop designed to stimulate innovation by bringing together a diverse group of people to explore a specific technology challenge in a new way.

Divergent CollaborationSM emerged as a result of a Tech-Arts Project that brought together local artists and engineers in January 2011. This pilot project was successful in infusing new ideas and non-traditional thinking into AFRL's information visualization technology development activities.

While most of us collaborate with people we know or who have similar backgrounds, this static approach to problem-solving often produces predictable results. That's where you come in. Based on your area of expertise and the unique perspective you can provide as a [profession/ area of expertise] we would like to invite you to participate in a Divergent CollaborationSM workshop. *[You were recommended by _____].*

By harnessing the mental models and tools from a variety of professions operating adjacent to the problem at hand, we believe novel and innovative outcomes will result. Your distinct background and knowledge can provide new insights into potential solutions to the challenge facing the U.S. Air Force today: *[insert problem]*. *[Brief, one sentence explanation of the problem]*.

The workshop will take place [insert date] at the Tec^Edge facility in Dayton, OH. *[If participant is travelling: We are prepared to compensate your travel costs to attend. If participant is not AF or DoD: We are prepared to offer compensation based on your time and effort]*. In order to measure the effectiveness of this workshop, assessments dealing with the process, outcomes, and participants, in the form of questionnaires, will also be administered. Lunch will be provided both days, as well as an evening social hour on the first day.

We appreciate and greatly value your participation in this exciting opportunity for collaboration. You can find more information on Divergent CollaborationSM, the challenge, the IDEA Lab, and the team leading this effort, in the attached flyer. Please respond with your participation availability as soon as possible but no later than [insert date] via email at candace.treasure@wbi-icc.com.

Sincerely,

Candace Treasure and the Divergent CollaborationSM team

7.3. Appendix C – Demographic Information for Resiliency Participants

Gender

- Female: 6 (43%)
- Male 8 (57%)

Age:

- 20-29 3 (21%)
- 30-39 1 (7%)
- 40-49 2 (14%)
- 50-59 3 (21%)
- Over 60 5 (36%)

Education:

- Post Master's Degree 8 (57%)
- Master's Degree 3 (21%)
- Undergraduate Degree 2 (14%)
- High School Diploma 1 (7%)

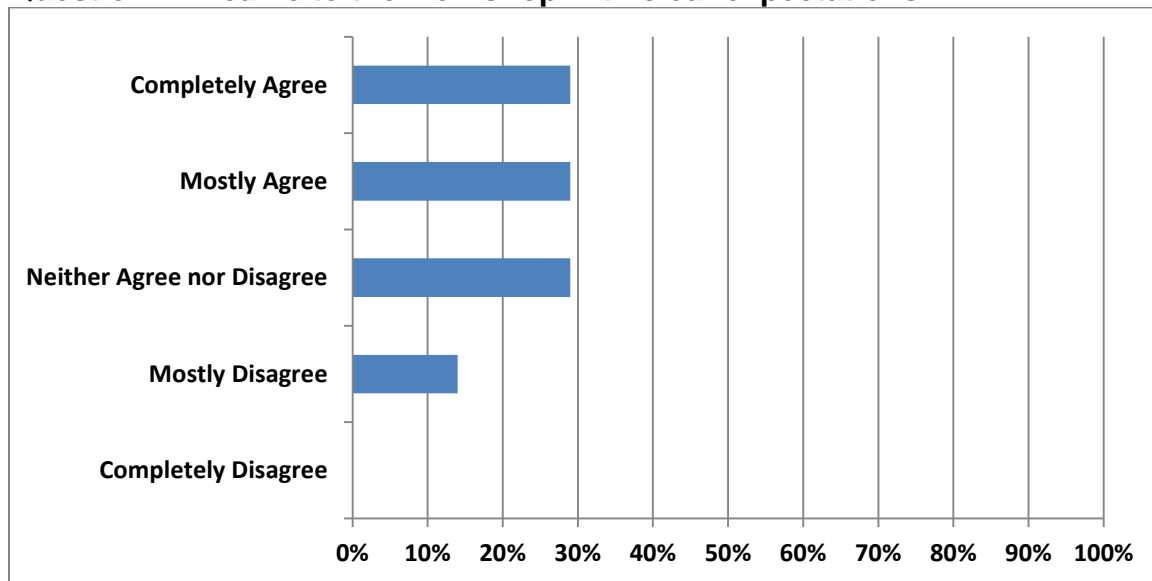
7.4. Appendix D – Comprehensive List of Ideas from the Resiliency Group

- Provide emotional support
 - Mentor; ongoing and consistent relationships; enhance supervisor training; change stigma of getting help; better assessment tools
- Improve work environment
 - Human factors; sensory integration; enhance sense of community through technology and social media
- Required group debriefs
- Physical activity on a regular basis
- Awareness of effects (kills)
- Holistic approach of looking at warfighter's life
- Awareness of resiliency – training, best practices, how to be resilient
- Options for open and anonymous feedback
- Longitudinal studies of warfighters
- Required single status
- Controlled social support
- “A day in the life”
 - Simulation for spouses, girlfriends, family, or support groups to see the work their loved one does on a daily basis
- Educate the public
- Individual assessments
 - EEG/fMRI; social networks; expectation checking; perception checking
- Continuity of Care
 - Pre, during, and post assignment
- Institute selection requirements in terms of resiliency of individuals
- Identify variables that make a person resilient and support them in continuing that behavior
- Explore Forensics
- Morale assessment
- Educate people on how to move in and out of structure all the time
- Institute teacher/mentor, preferably a peer
- Generalize physical mission training to individual wellness
- Technological advances that impact morality

- Leadership supports life resiliency activities and gets graded on it.
- Provide education/services for people who want to take advantage of them and incentive program participation

7.5. Appendix E – Summary of Resiliency Process Questionnaires

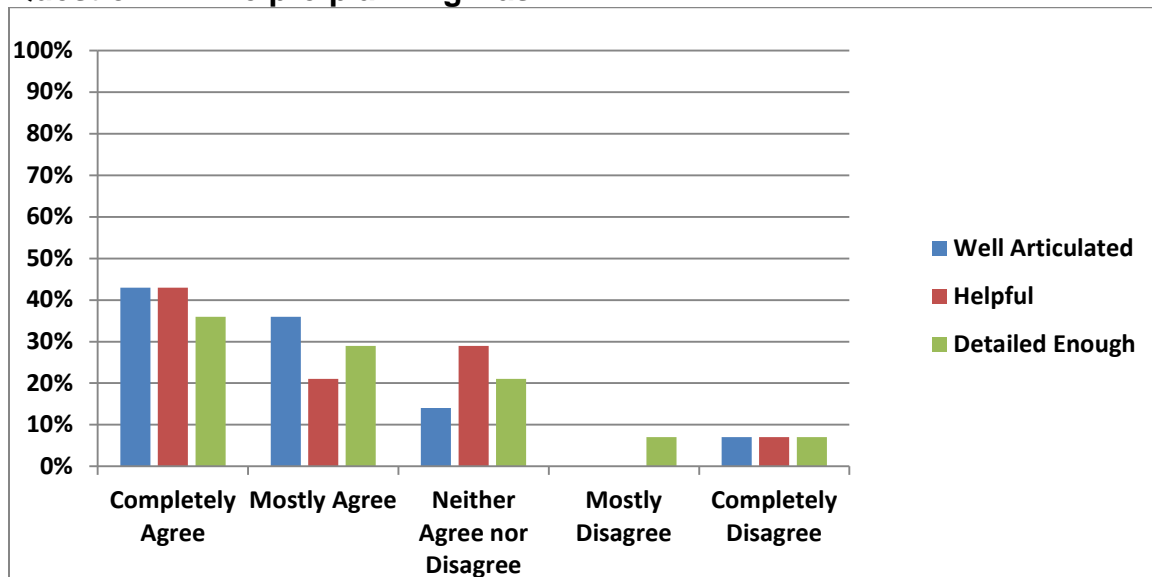
Question 1: I came to the workshop with clear expectations.



Comments from participants:

- “I mostly disagree, but more clarity would have been problematic/limiting creativity”
- “Tried to be open minded”
- “A bit ‘fuzzy’ but this actually made the workshop more spontaneous and perhaps more authentic”

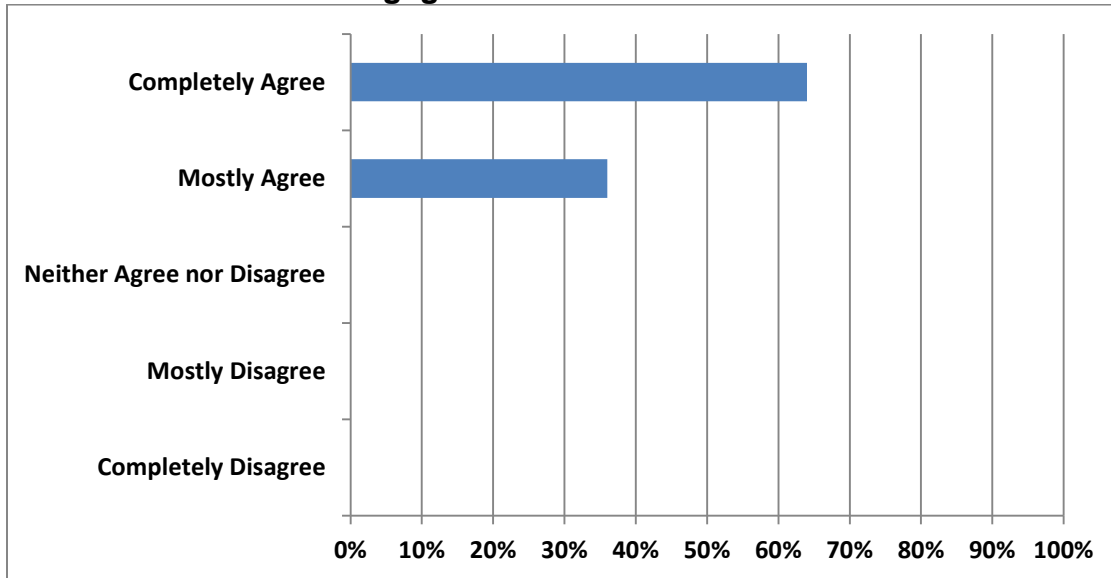
Question 2: The pre-planning was:



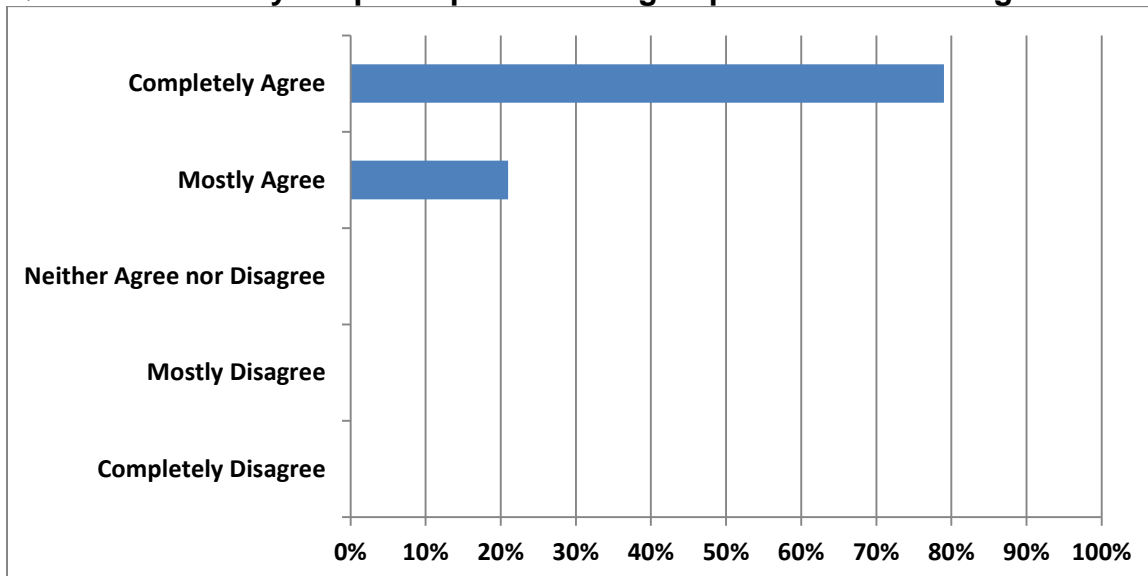
Comments from participants:

- “Good that not much info provided at first”

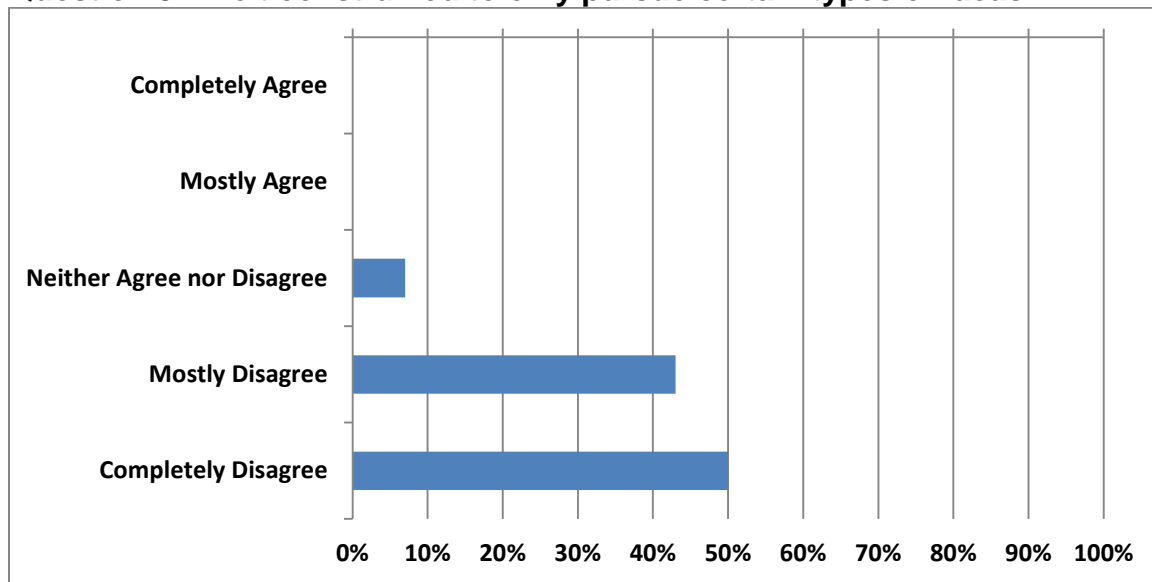
Question 3: Terms of engagement were clear.



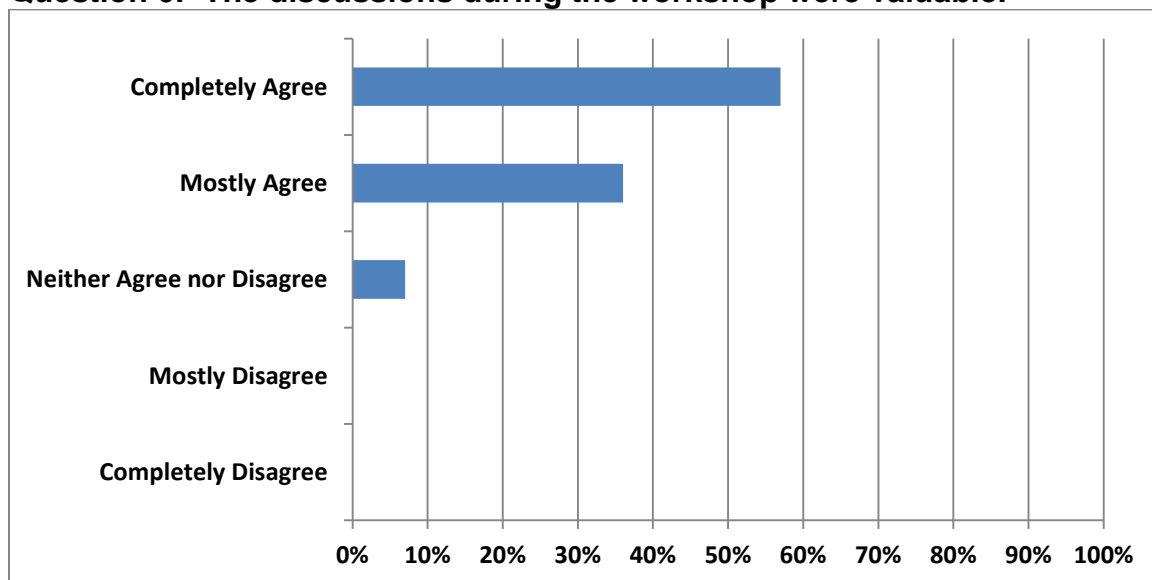
Question 4: Everyone participated in the group discussion during the workshop.



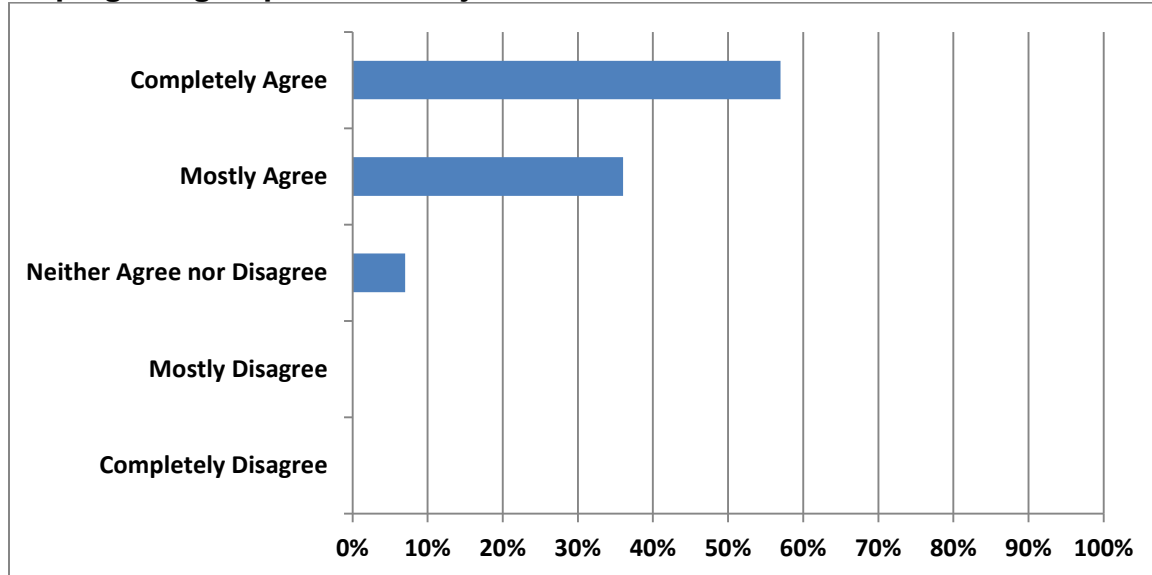
Question 5: I felt constrained to only pursue certain types of ideas.



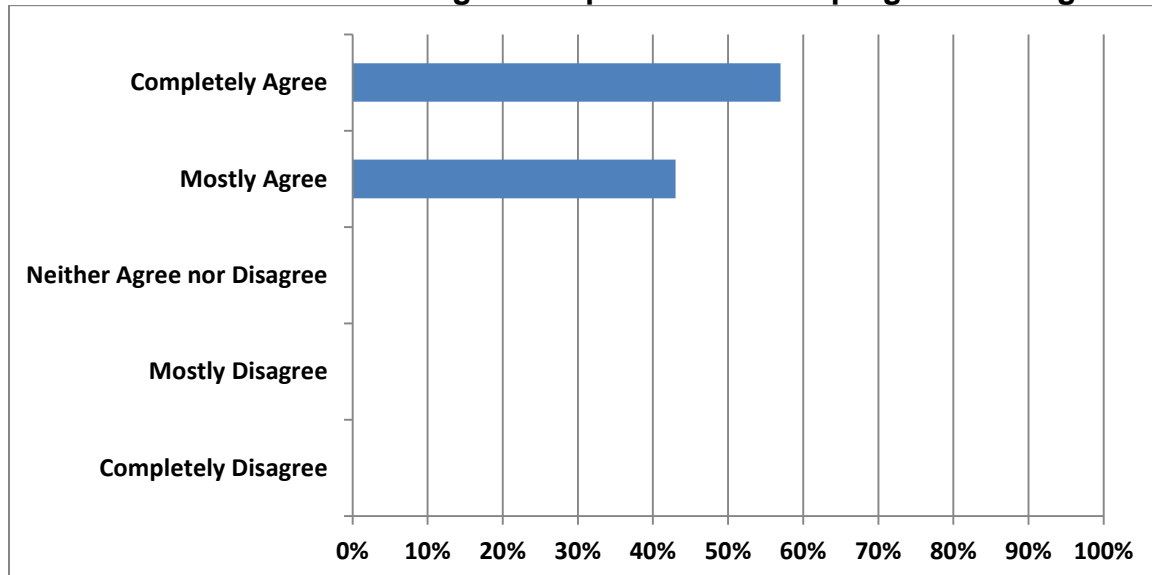
Question 6: The discussions during the workshop were valuable.



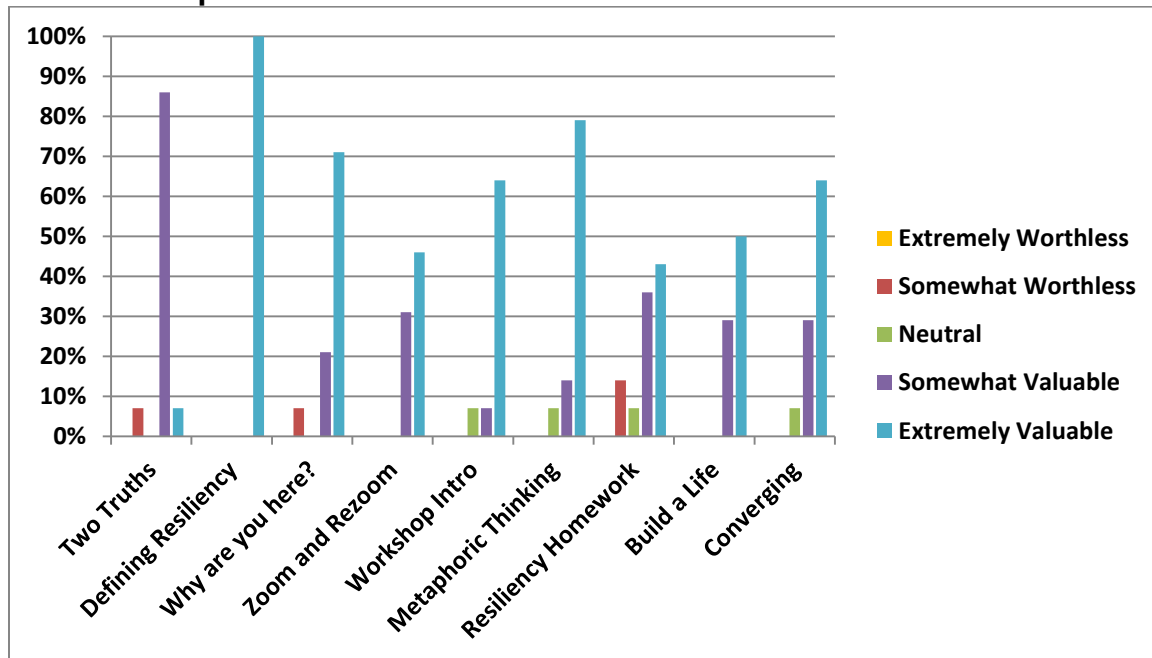
Question 7: The process and activities used in this workshop were essential in helping our group meet its objective.



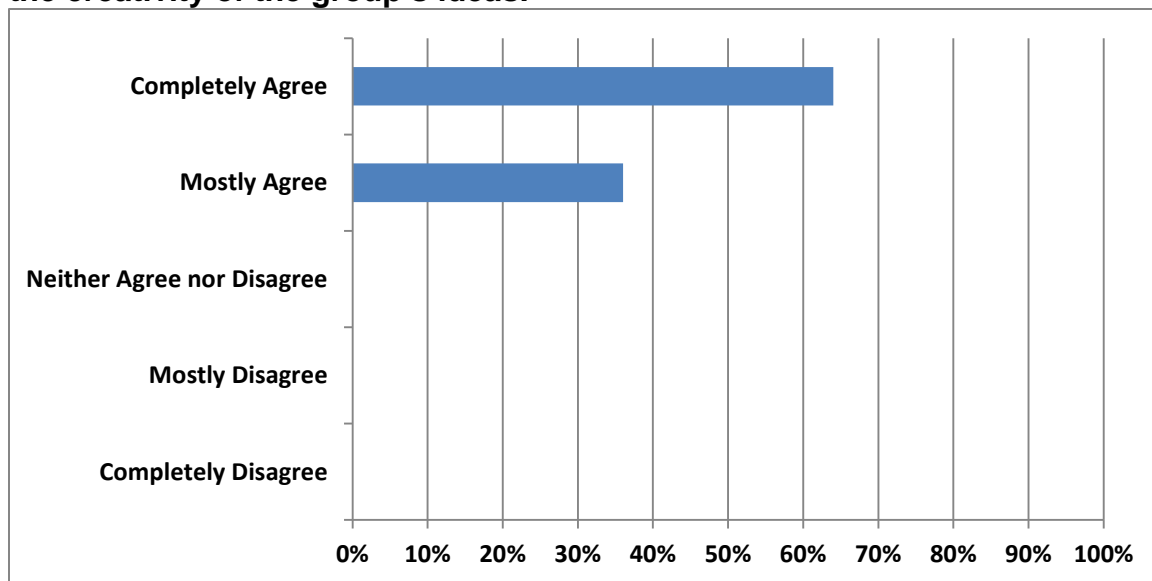
Question 8: The Process Diagram helped me to track progress during the workshop.



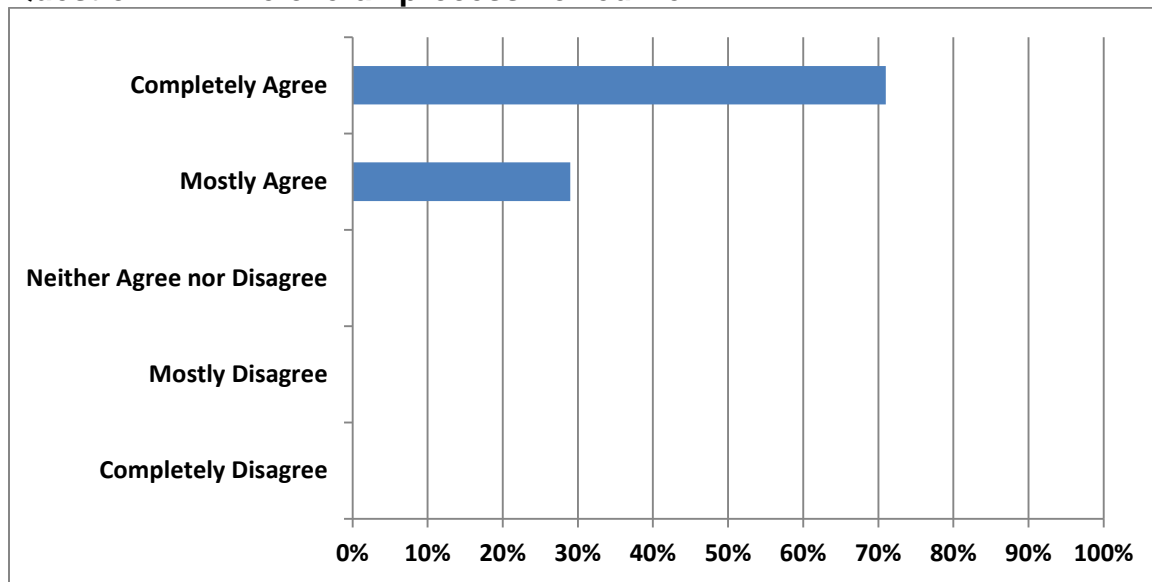
Question 9: Rate the activities below in terms of if you think they were valuable to the workshop.



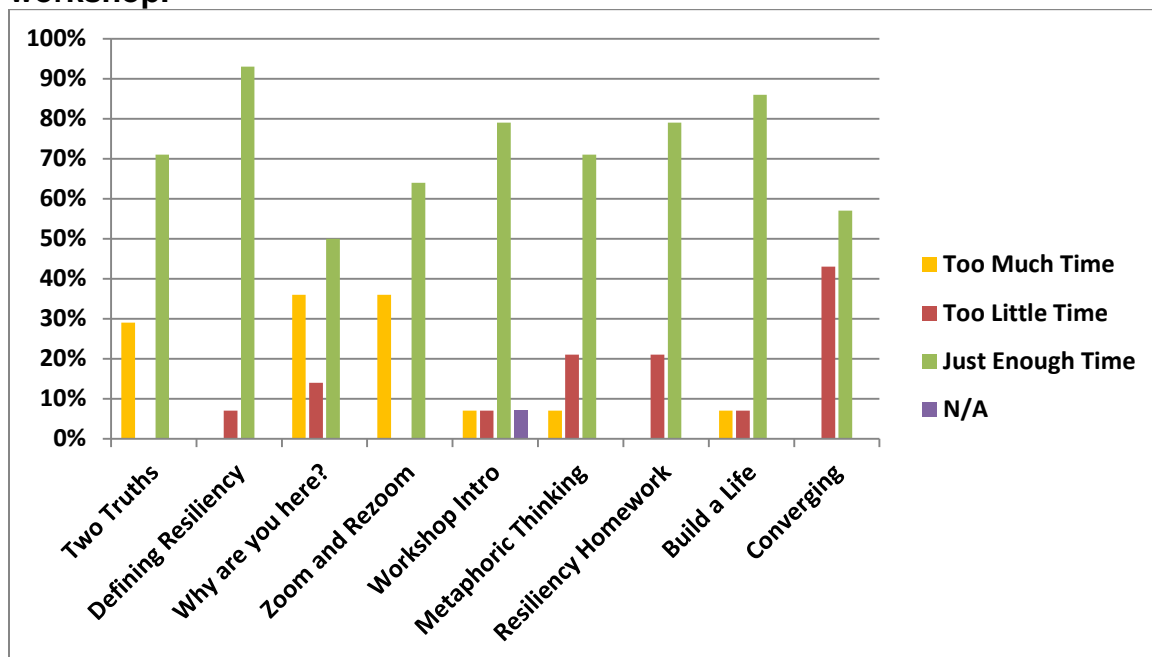
Question 10: The process and activities used in the workshop significantly enhanced the creativity of the group's ideas.



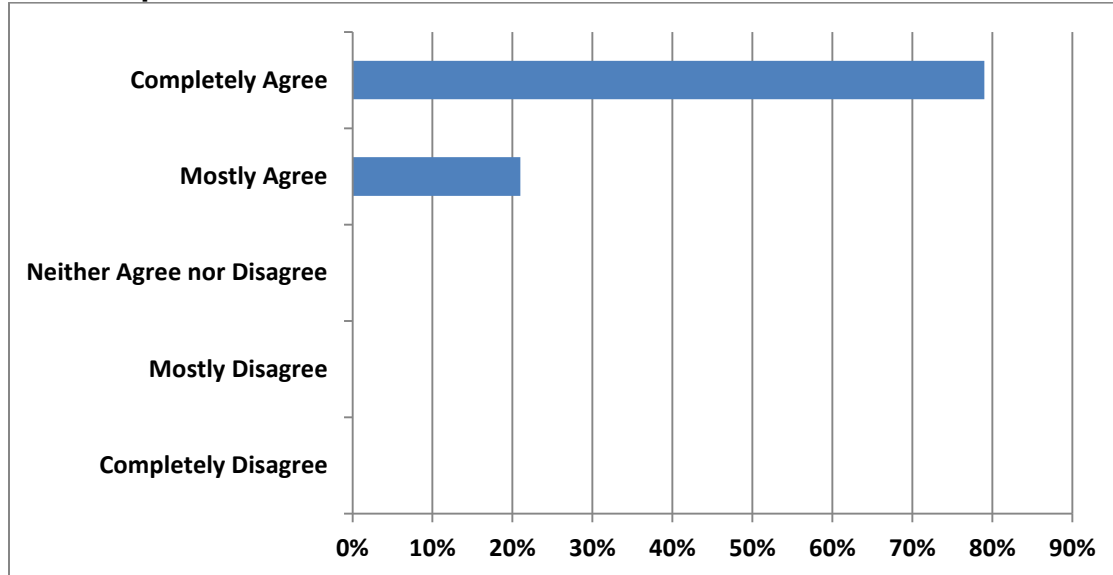
Question 11: The overall process flowed well.



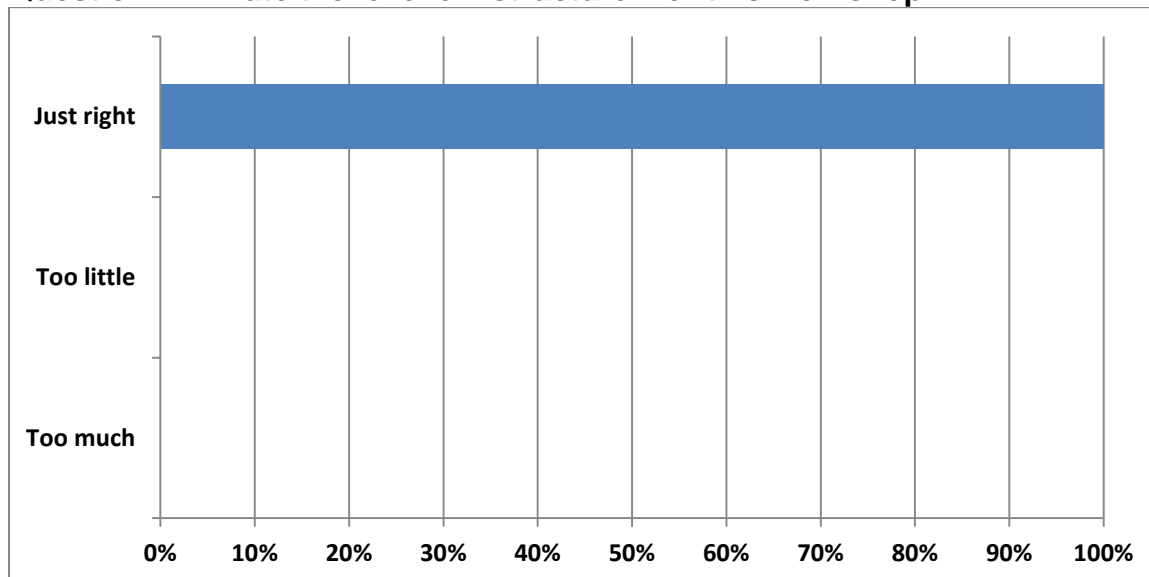
Question 12: Rate the length of time spent in each of the following areas during the workshop.



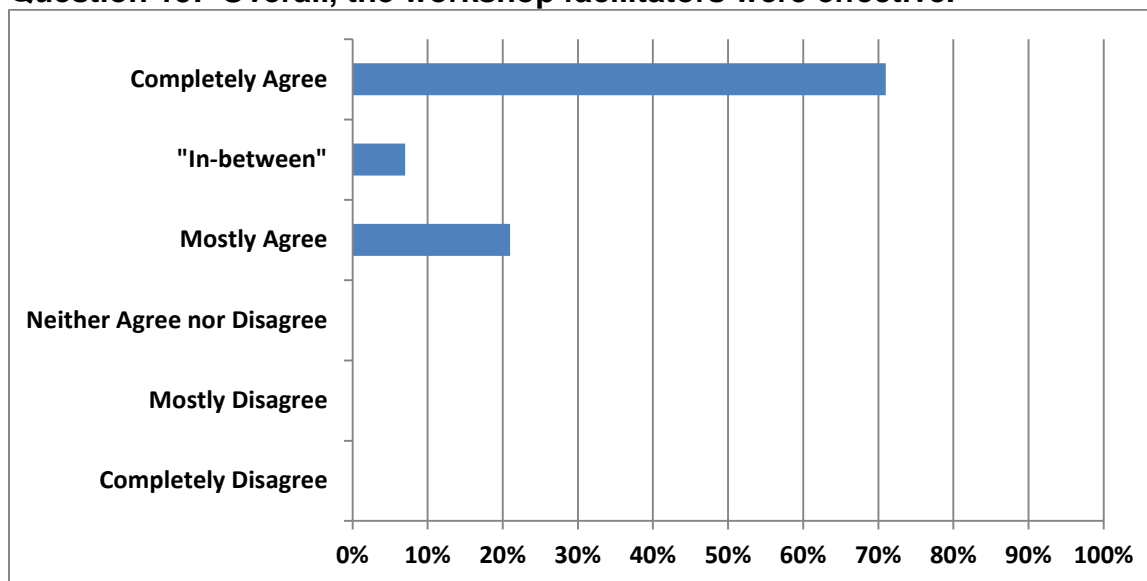
Question 13: The group took full advantage of the activities introduced during the workshop.



Question 14: Rate the level of “structure” for this workshop.



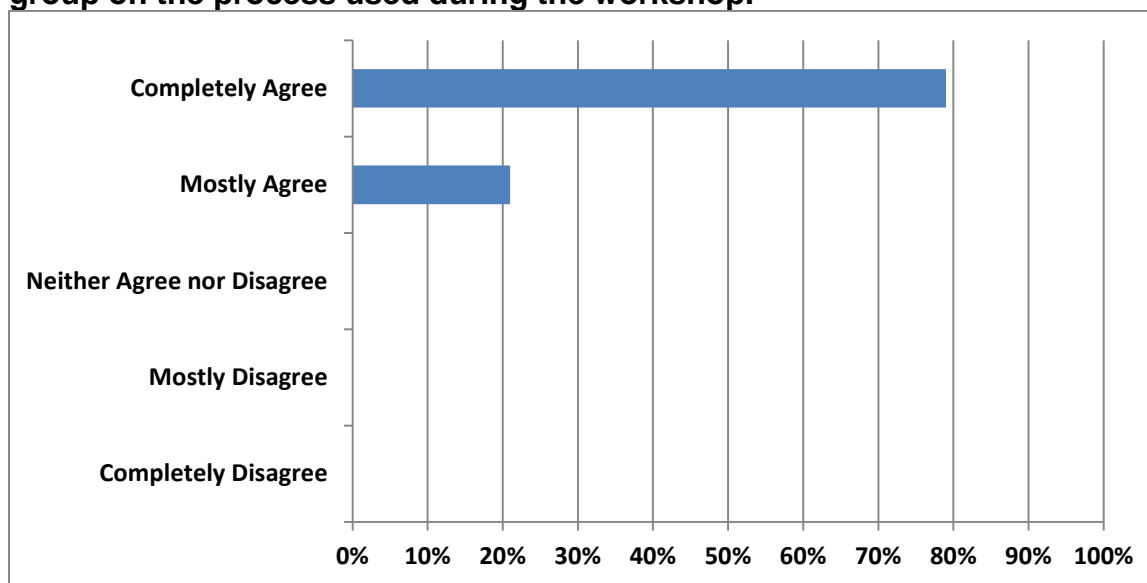
Question 15: Overall, the workshop facilitators were effective.



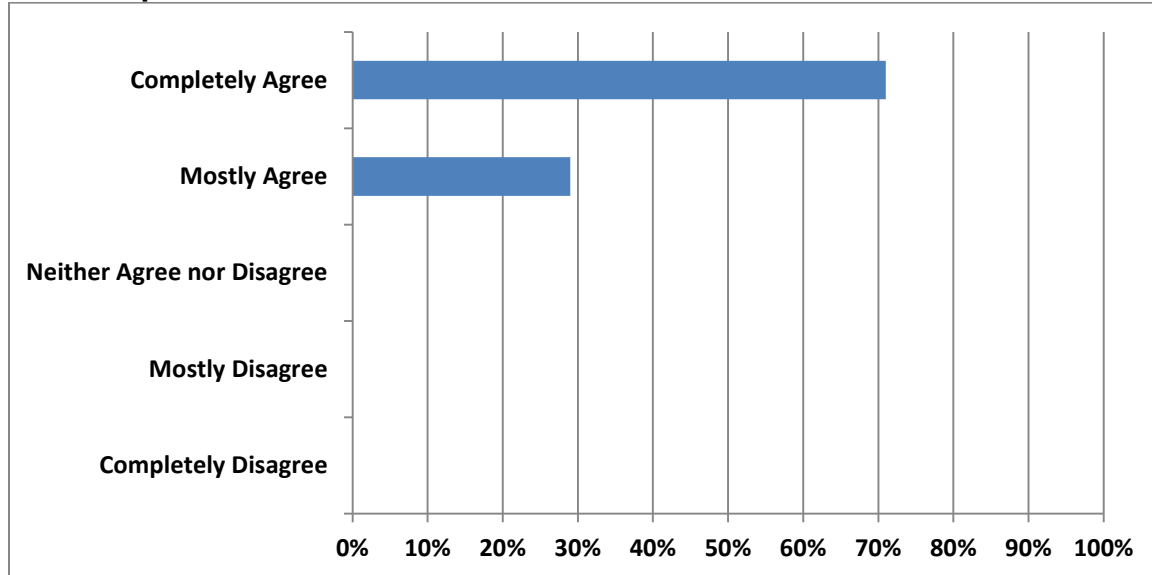
Comments from participants:

- "On target-listening-helpful-never too heavy loaded but kept us on course"
- "Some people tried to sell ideas (products) too much"

Question 16: The workshop facilitators had sufficient knowledge to instruct our group on the process used during the workshop.



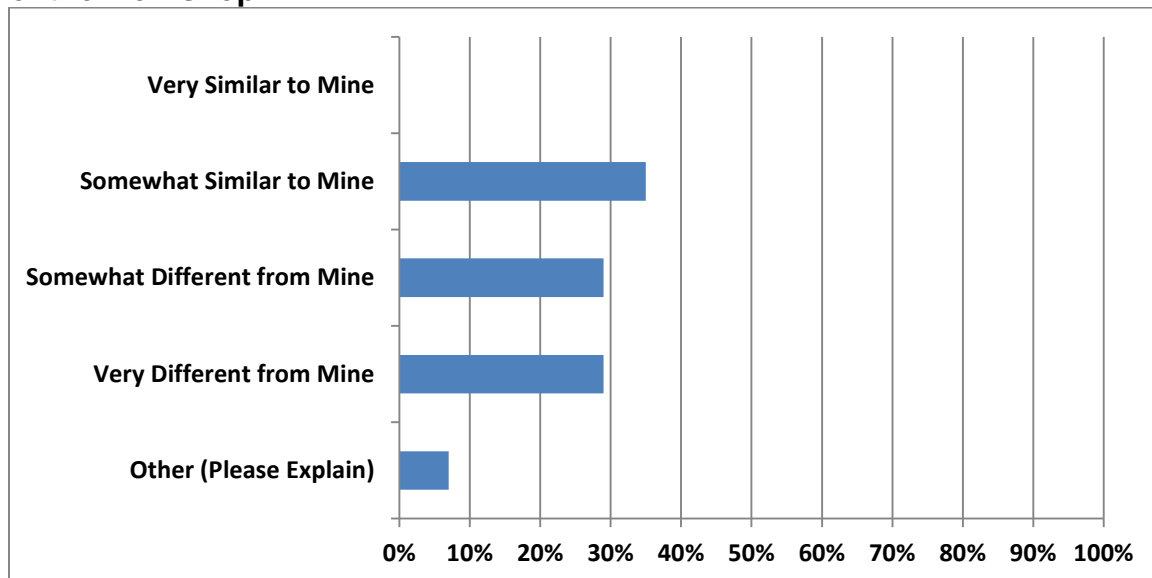
Question 17: The workshop facilitators answered questions effectively during the workshop.



Comments from participants:

- "Very helpful to have others (facilitators and/or project people) create group flip charts so we stayed focused on topics and ideas flowing"

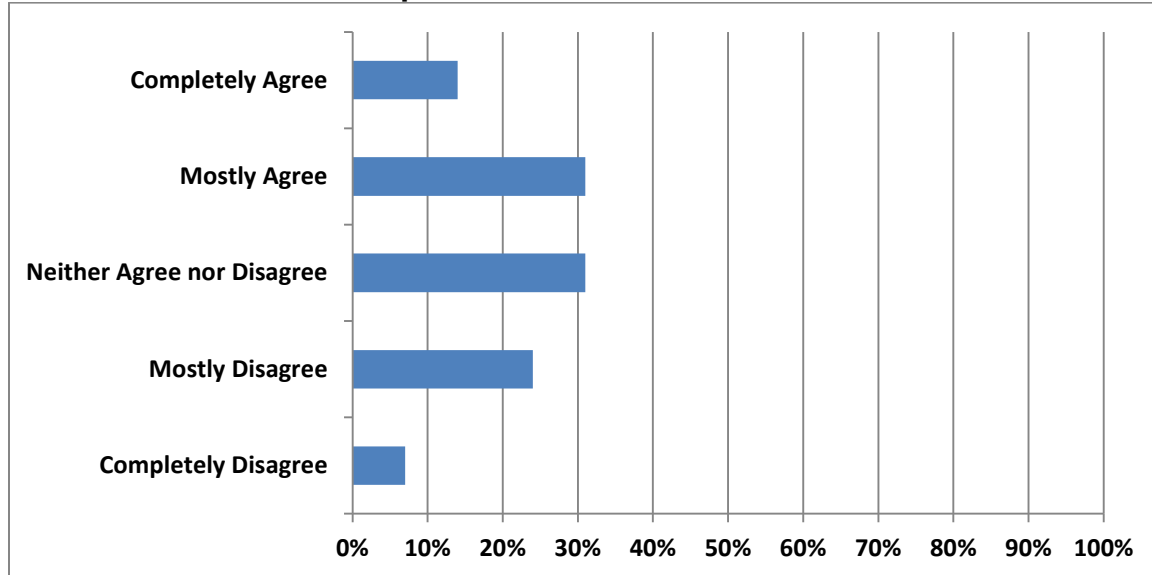
Question 18: Describe your area of specialization as compared to the other members of the workshop.



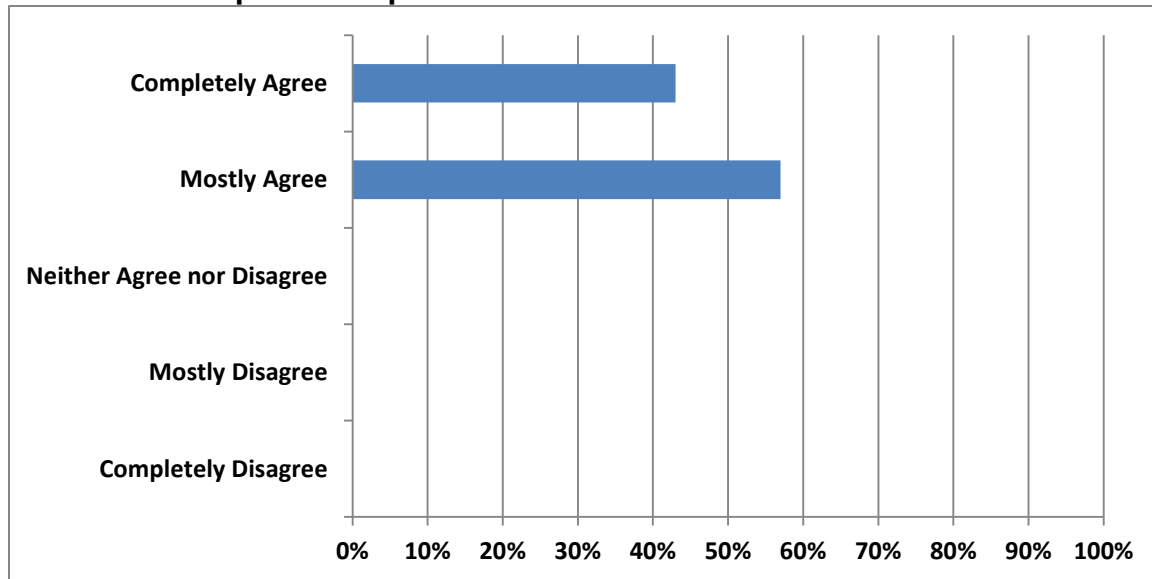
Comments from participants:

- "Different specialties but similar creative and free thinking"

Question 19: I had a great deal of prior knowledge/expertise on the topic/problem we examined in this workshop.



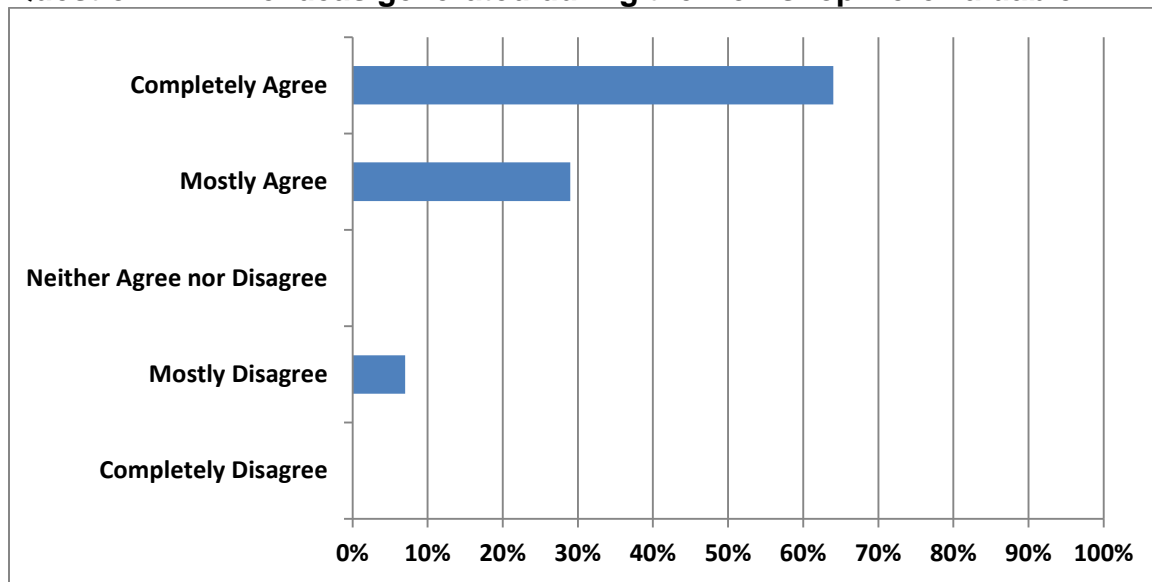
Question 20: The knowledge and experience of the workshop participants were sufficient to explore this problem.



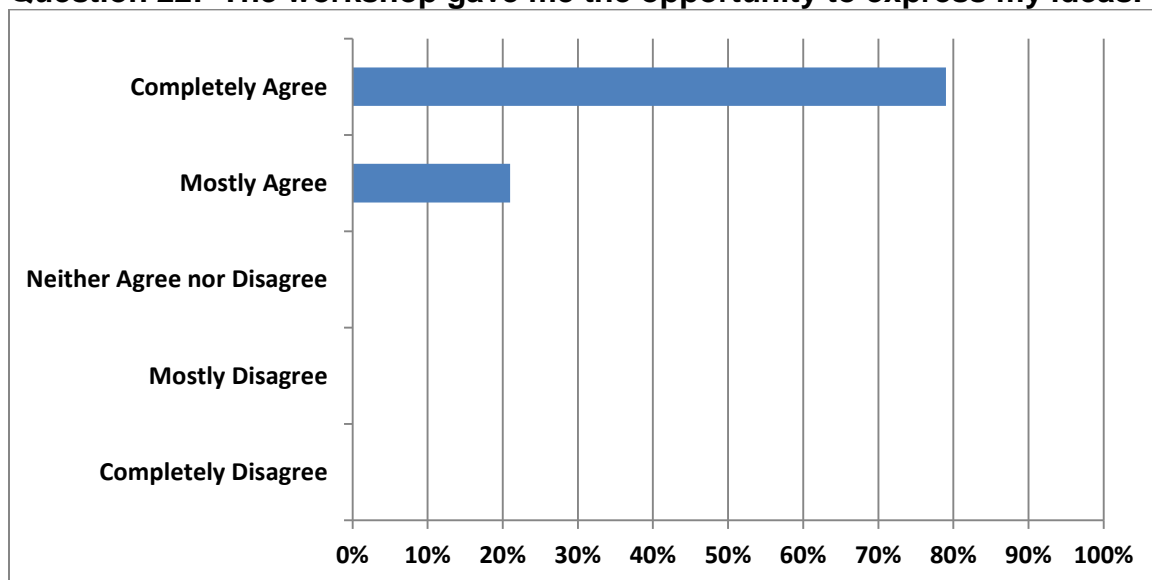
Comments from participants:

- "Should have people who were deployed in units/activities in question"

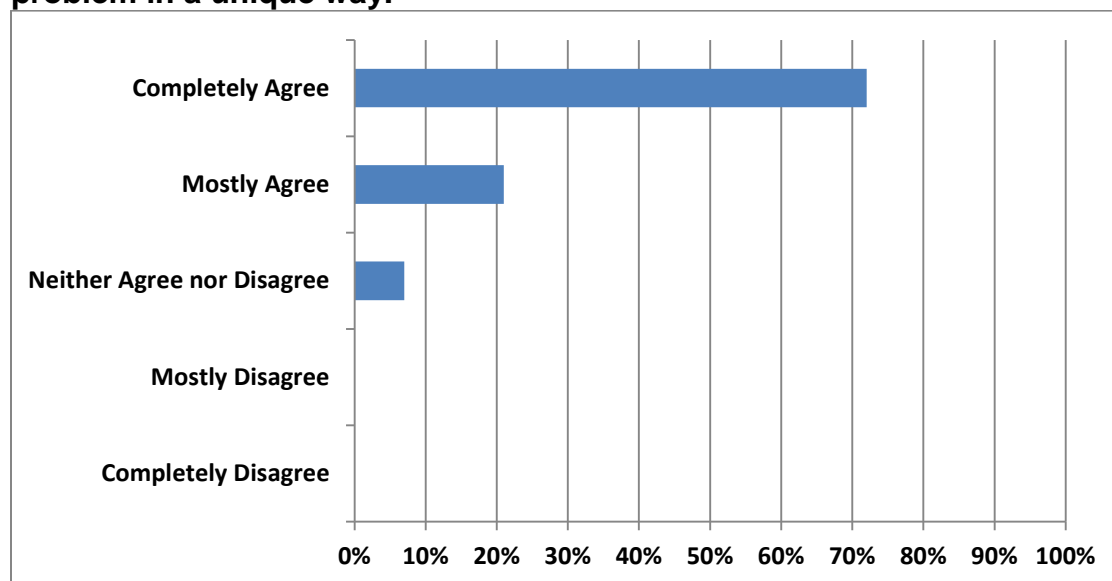
Question 21: The ideas generated during the workshop were valuable.



Question 22: The workshop gave me the opportunity to express my ideas.



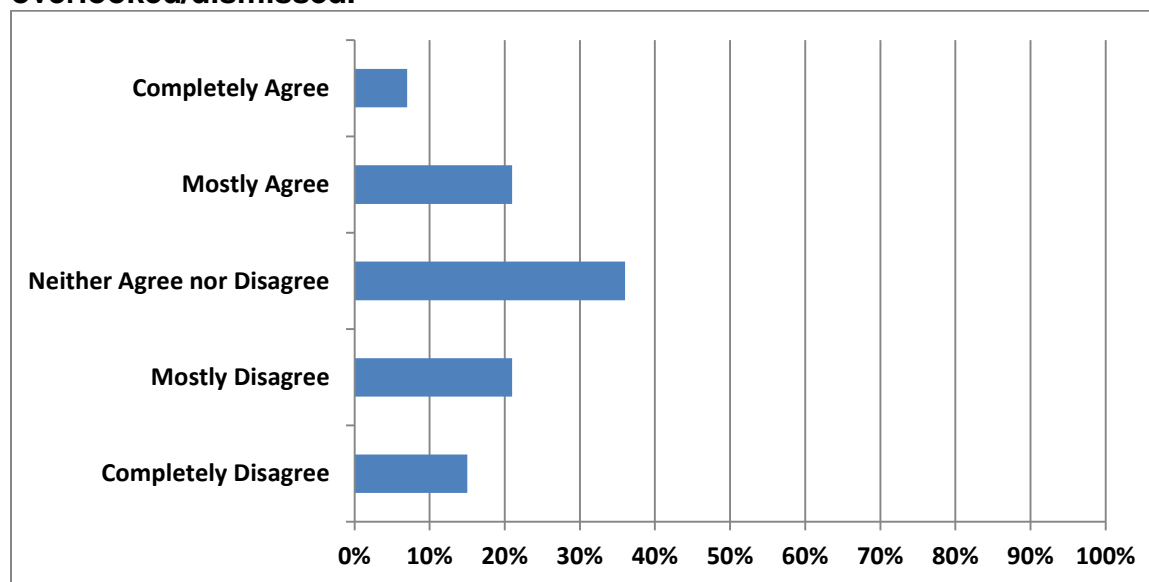
Question 23: At one or more points during the workshop, the group approached the problem in a unique way.



Comments from participants:

- "Peace and war as resilient ideas captured so many ways people are resilient."

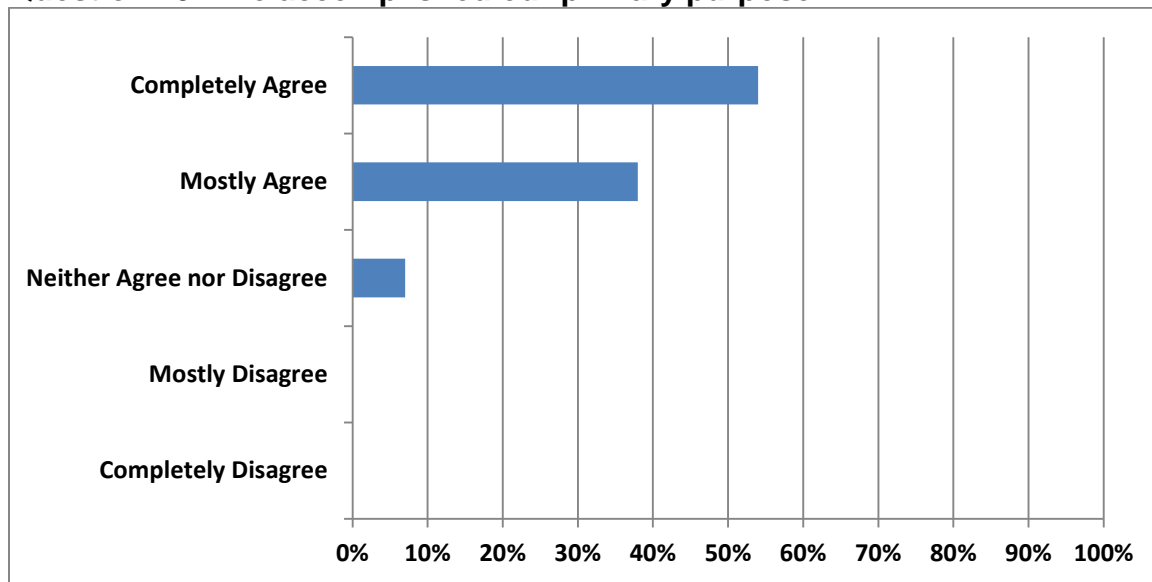
Question 24: In looking back, I believe there were ideas that our group overlooked/dismissed.



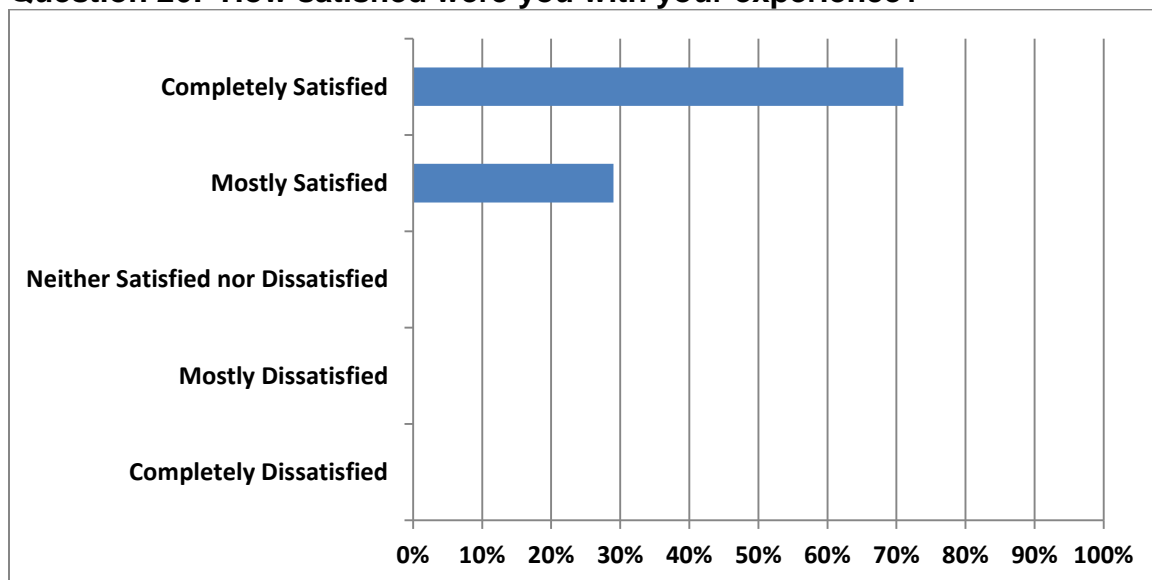
Comments from participants:

- "Could have used a bit more problem background to trigger ideas."
- "Nothing major but of course there are many ways of thinking...the universe of possibilities is infinite."

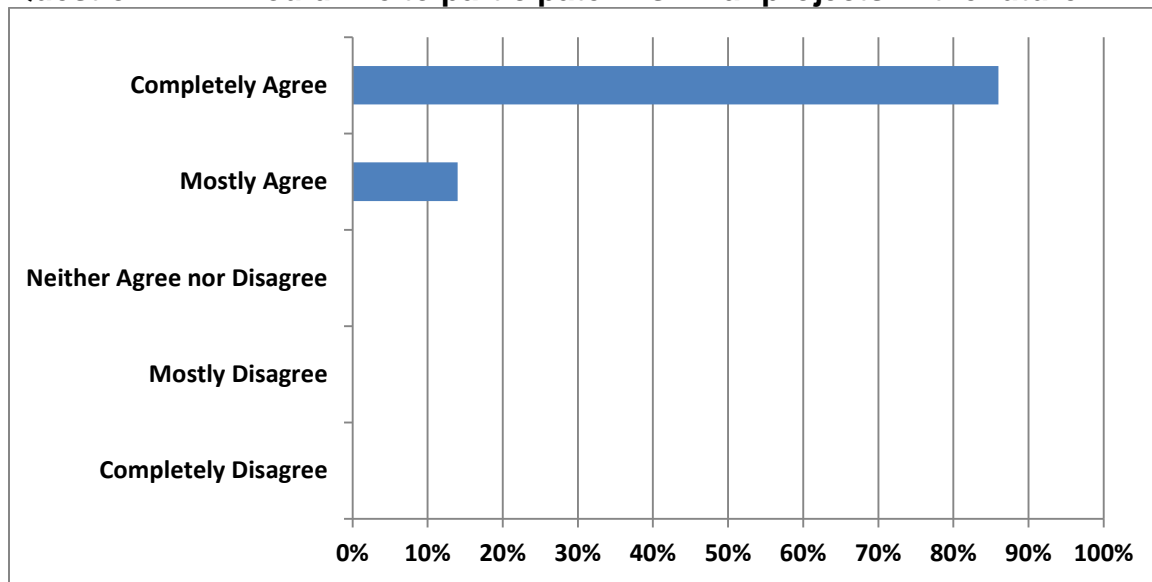
Question 25: We accomplished our primary purpose.



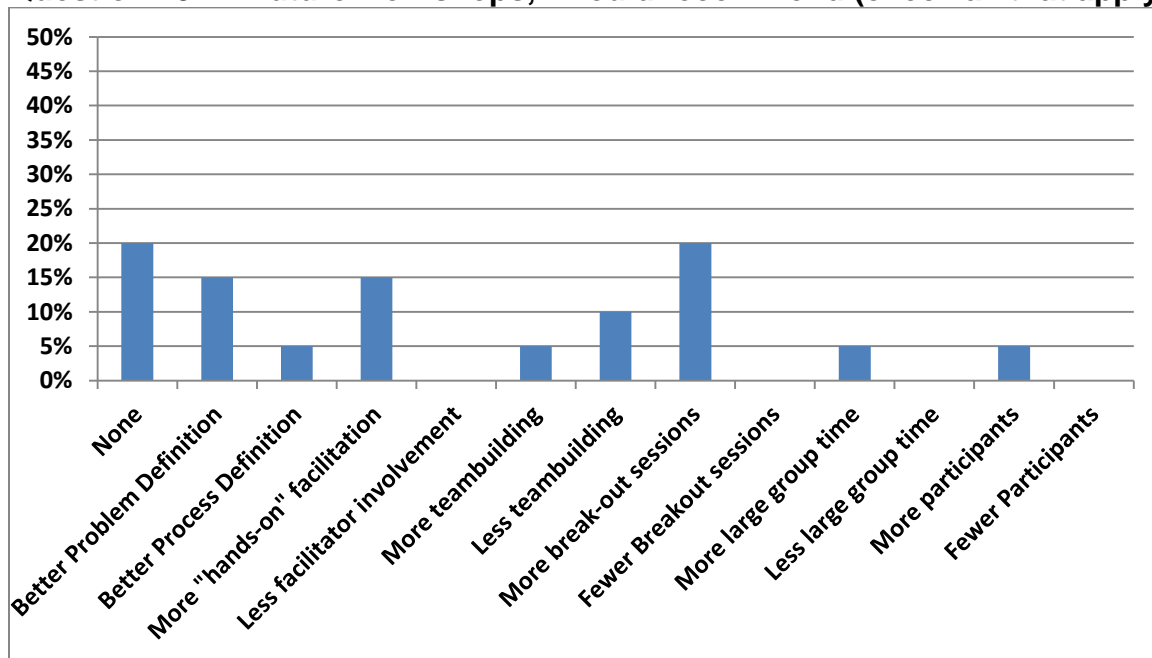
Question 26: How satisfied were you with your experience?



Question 27: I would like to participate in similar projects in the future.



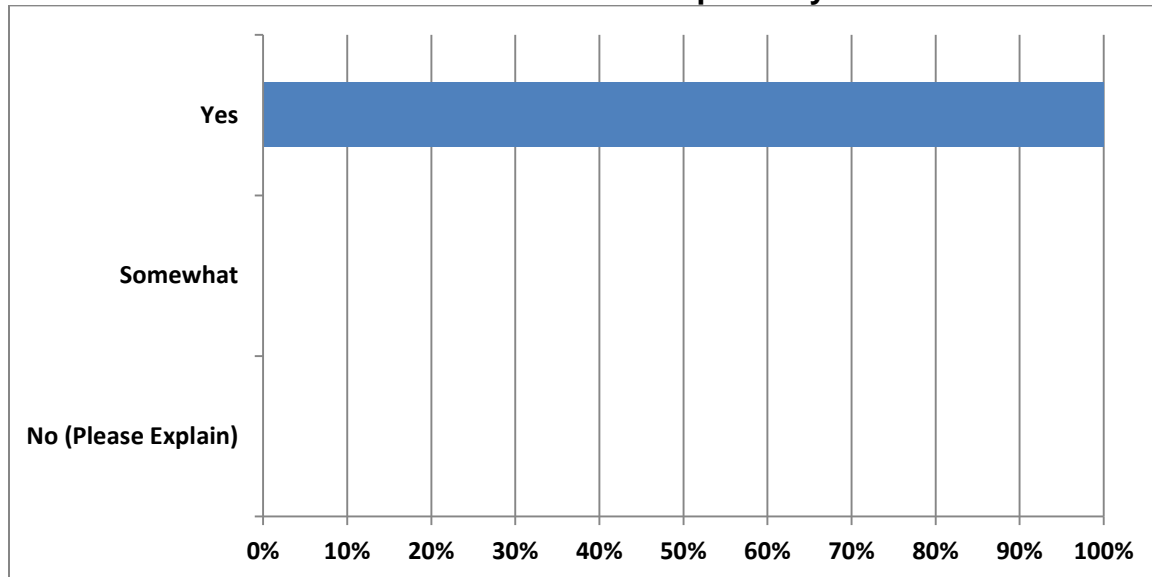
Question 28: In future workshops, I would recommend (check all that apply):



Comments from participants:

- "I liked the way it was conducted"
- "No, comes out in the group" (in regards to "better definition of problem")
- "More break-outs...and serious group homework, if possible"
- "better definition of what has been done by the team from WP"
- "Less large group time during 'why' am I here part"
- "More participants with direct experience. Maybe some unsuccessful too"

Question 29: Did the location of the workshop meet your needs?



Comments from participants:

- "Very good"

Question 30: What activities did you like most/least?

Participant Comments:

MOST

- "Open discussion on the areas of opportunity to solve the problem"
- "Group discussion"
- "(1) Connecting the dots after we'd interacted as a group to define resiliency. (2) Build a Life – how we think – how we work – how we listen – a great reminder for being open to everyone. (3) Divergent activity on 2nd day in AM"
- "Breaking off in groups and returning to large group to converge"
- "I liked the converging the most"
- "I enjoyed breakout sessions however they were challenging due to the "divergent" personalities and styles in the group!"
- "Group discussions and zoom and re-zoom"
- "Break-outs"
- "The zoom and re-zoom I liked the most"
- "Defining problems from different perspectives"
- "Converging"

LEAST

- "Too much time (for me) spent on zoom and re-zoom"
- "Build a life"
- "Too truths. I would have liked to have a brief description of who they are and what they do, though it did provide a good mind stretch activity"
- "Two Lies and a Truth"
- "Listening to long stories, some not relevant to the topic"

- “Two truths activity”
- “I really didn’t have an activity that I liked least”
- “Maybe another point of this is what I liked least. We kept returning and rehashing same/similar ideas or experiences. Also maybe too abstract with nothing to measure to show if we could affect the problem”

POC Comments:

- “Metaphor video was a good and simple activity. Separated groups were key! Good job.”

Question 31: What was your overall impression of the Divergent CollaborationSM Workshop?

Participant Comments:

- “It was an amazing experience, variety of experience and opinions created many different solutions of routes to take”
- “As I told Candace yesterday, I really appreciated being part of a 2 day think tank. The workshop gave me/us the feeling that we were a part of something much bigger that could change the world – thank you”
- “I found both the conceptual content and the process fascinating”
- “It was a positive experience – eye opening as to the challenges the Air Force is addressing (size and scope). The facilitation team had created a well designed workshop that allowed and encouraged participants to be open, to share, to trust one another and to see real value in the work we were asked to do”
- “Interesting and worthwhile because of well planned session and group of diverging individuals”
- “(1) Excellent, knowledgeable and diverse participants, who appeared to fill in all the gaps. (2) Excellent guidance and stimulation of the participants in creative and open thinking to improve problem solving skills. (3) I feel very useful suggestions were recommended to the Divergent CollaborationSM project.”
- “Very interesting concept. The participant who had experienced being deployed was valuable to the group. Facilitators were helpful and kept the group on track”
- “Very good. Not sure if we actually “solved the problem”. I feel like there might be research/tools already developed that would help (i.e., The Resilience Scale).”
- “Fun, interesting approach, nice break from daily work, productive, real question will be translation into effective solutions”
- “I believe this workshop was very effective. Not only did I learn a lot about the U.S. Air Force, I feel like I brought a lot of good concepts to the table to assist the Air Force in being resilient.”
- “Effective in learning varied approaches to a problem. Must now be ‘firmed up’ with definition of ways to evaluate success.”
- “Great experience/great facility. Glad to participate/would like to again. Knowledgeable, friendly people who believe in their mission.”

POC Comments:

- “Good → from my perspective, it appears that if this was the first step in this whole process it would have been much more valuable.”

- “(1) The process can be a motivational tool. (2) It is helpful to validate ideas. (3) Overall, I was satisfied. However, I do not think it led to major changes in perspective. More time is needed to familiarize participants to the problem space. For example, I assume the art-engineer project took months.”

Question 32: What changes could we make to improve future projects?

Participant Comments:

- “More time”
- “I really enjoyed this process. I would, however, appreciate hearing more about what you – the experts – have already found in your research about resiliency”
- “Be more aware of those who haven’t shared and solicit their opinions. Monitor the amount of time those who are extraverted take to share their ideas”
- “I like the V shape room but too many people were concentrated at the other end of the room – that I felt separated from them. Loved having windows – good food – great chairs – and a project I highly value.”
- “More people who were deployed in groups and situations in question. Perhaps broaden your participant base → artists, electricians/carpenters/retail/advertising”
- “I would have liked to hear the areas where majority of problems occurred. During most of the workshop I was picturing the combat type of soldier, not “maintenance crew”. It might be beneficial to involve a business leader and also a representative who has close contact with the typical “soldier” or military person such as a school teacher who deals with large volume of teens who may enlist”
- “A more diverse group – I think you tried, but we ended up being more similar than different”
- “(1) It would be good to hear some outcomes downstream (2) 1-2 facilitators lost track of rules of engagement by pushing back in ‘divergence’ with ‘this is what we do’ or ‘we’ve tried that’ limiting comments. Not a big problem, but did occur (3) Controlling off-topic story telling is always a challenge”
- “I don’t see any changes needed besides continuing to strive for diversity because in my experiences different opinions/ideas make the problem solving much more elaborate and considerate to all walks of life”
- “Someone made a comment that still more diversity might be useful. Idea I think was that most in this session have been successful (resilient) and that somehow others might broaden ideas”
- “(1) Pre-reading, data that described the current state, etc. might/would have helped thought process (2) Explanation of ‘current state’ of affair – i.e. case study model would have been helpful (3) Now that I am interested in the subject, how do I continue to contribute? Make this activity less episodic – i.e. bring the team back in 1-2-3 months to share further thoughts or discoveries made based upon the exposure provided over the 1st 2 days. Thoughts and ideas take time to percolate!”

POC Comments:

- “Try to keep participants from selling ideas (products)”
- “It could: (1) be broken up into smaller sessions over more days – sort of “over it” by end of 2nd day, or (2) Shortened in general”

Question 33: Comments and/or Suggestions.

Participant Comments:

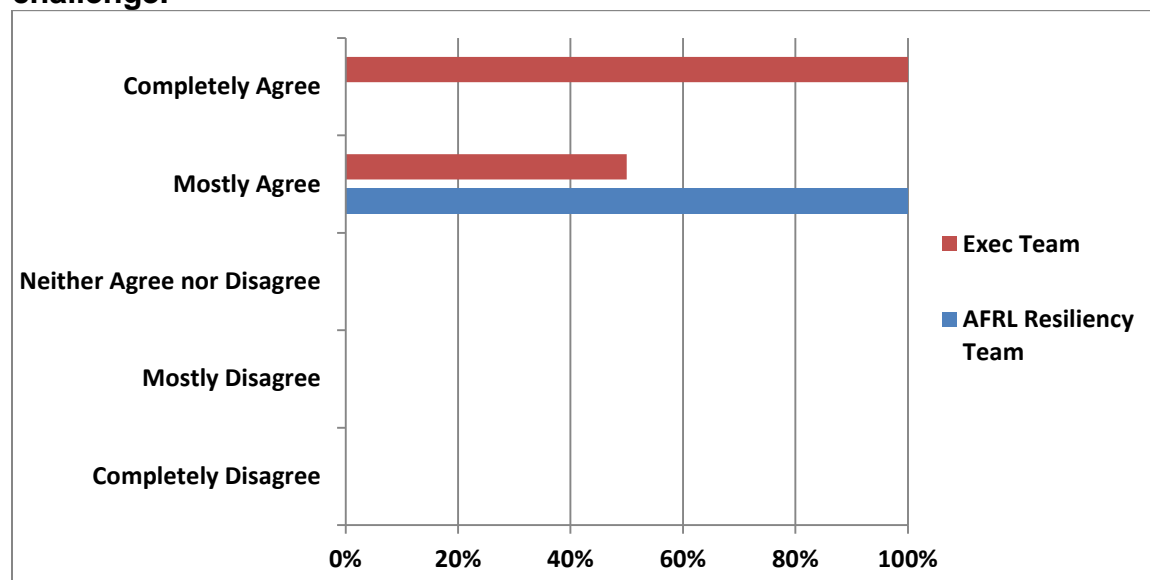
- “I just wanted to thank you for the invitation. This was an amazing opportunity, one which I have never had. The concept of diverge → converge is an incredible tool, it is a way of thinking that I will try to take home with me and apply to my daily life. One thing that was lacking was at least one airman from the USAF. It was good that I was there but since this is for the Air Force I feel that an airman from a Main Squad should have been invited/voluntold to come and contribute.”
- “A thoroughly enjoyable day-and-a-half! My only suggestion would, again, be monitoring who is participating and who is not so the process includes/involves every person”
- “Very professional! Thank you for this opportunity.”
- “The toys at the table were a plus”
- “Fighter food – high carb/meat can be sleep inducing; mid-day snacks; stick with cookies for dessert. Thanks!”
- “It is a delicate balance, but more attention needs to be paid to not allowing people to go off on tangents. As a former consultant, I “checked out” when the facilitator allowed a participant to give a 20 minute presentation on her research/profession. I remained checked-out during the rest of the morning activities. Others in the small break-out group appeared to agree, and another participant is the one that actually brought us back.”
- “This was a great 2 day workshop. The people from all different fields and professions provided a rich insight on what resiliency is as well as how we believe we can implement it in the U.S. Air Force. I must say in my own opinion, whatever changes are going to be implemented, I would suggest a pilot study first to ensure that the culture of the Air Force is not completely changed. As far as assessments to examine resiliency, I hope that a longitudinal study is started ASAP to examine the characteristics or traits that correlate with Resiliency. Without that taking assessments are pointless.”
- “I actually enjoyed most of this – especially hearing how others viewed the similar problem”
- “Would very much like to get contact information of all the attendees”

POC Comments:

None

7.6. Appendix F – Summary of Resiliency Product Questionnaires

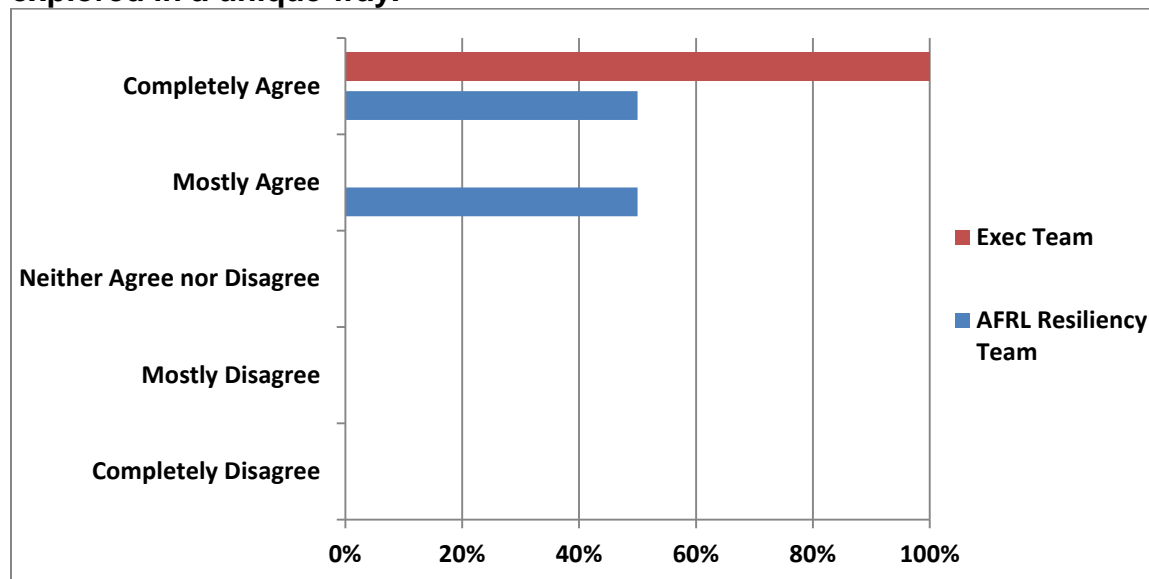
Question 1: The workshop helped me generate new insights into the resiliency challenge.



Comments from Exec Team:

- "The most profound thing Tony said: 'people have to believe that our country is great and war is necessary to help others. If they don't believe strongly in that, they have problems over there. But when they come home and they see all of the country's warts, they become disillusioned and all of the reasons they used to justify what they did come into questions. Then they question themselves. Then they lose hope. I think that scenario can describe anyone who becomes suicidal – disillusioned, questioning themselves and others, hopeless.' "

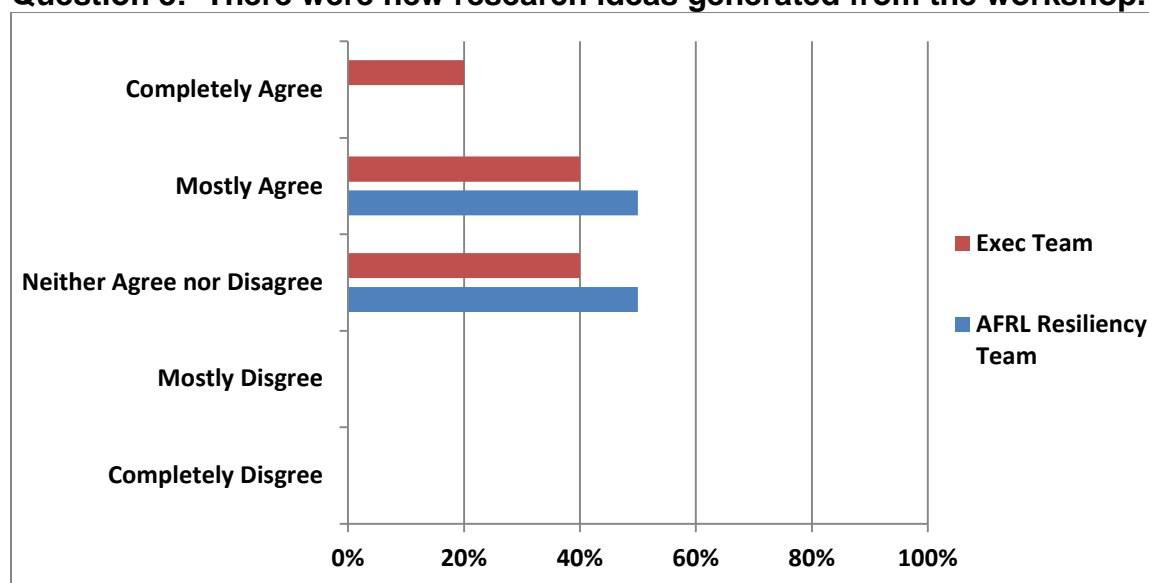
Question 2: At one or more points during the workshop, the problem space was explored in a unique way.



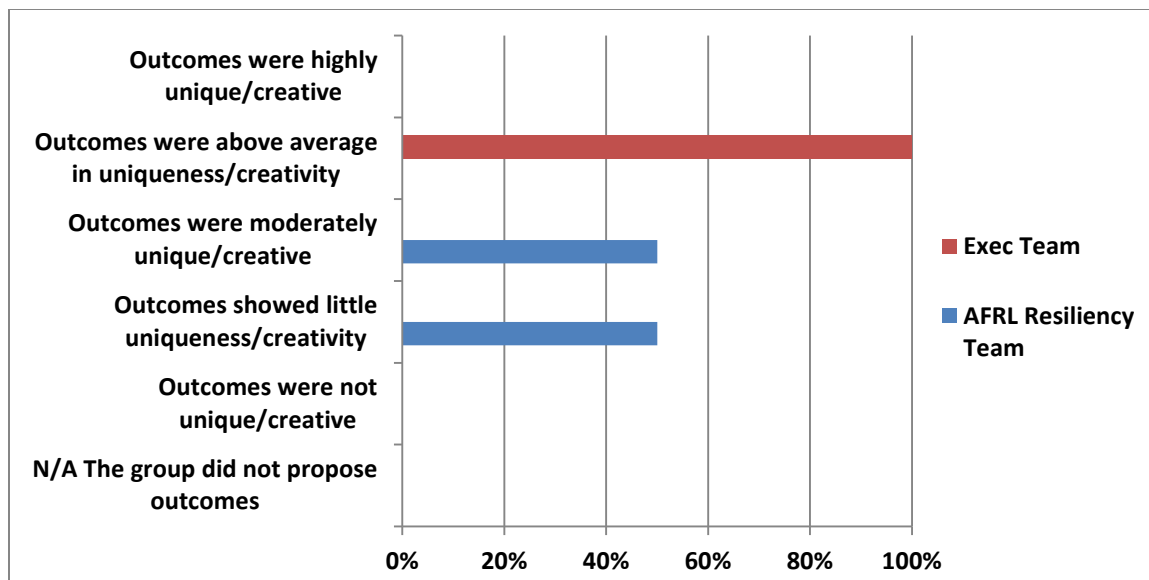
Comments from Exec Team:

- "During the metaphor session, we landed on the idea of independent resiliency and dependent resiliency. Independent resiliency was attributed to bugs, animals, and plants; dependent resiliency was attributed to things that require human maintenance to remain resilient, such as bridges, buildings, etc. We discussed human resiliency as a combination of both. This might be a good way to categorize different efforts."

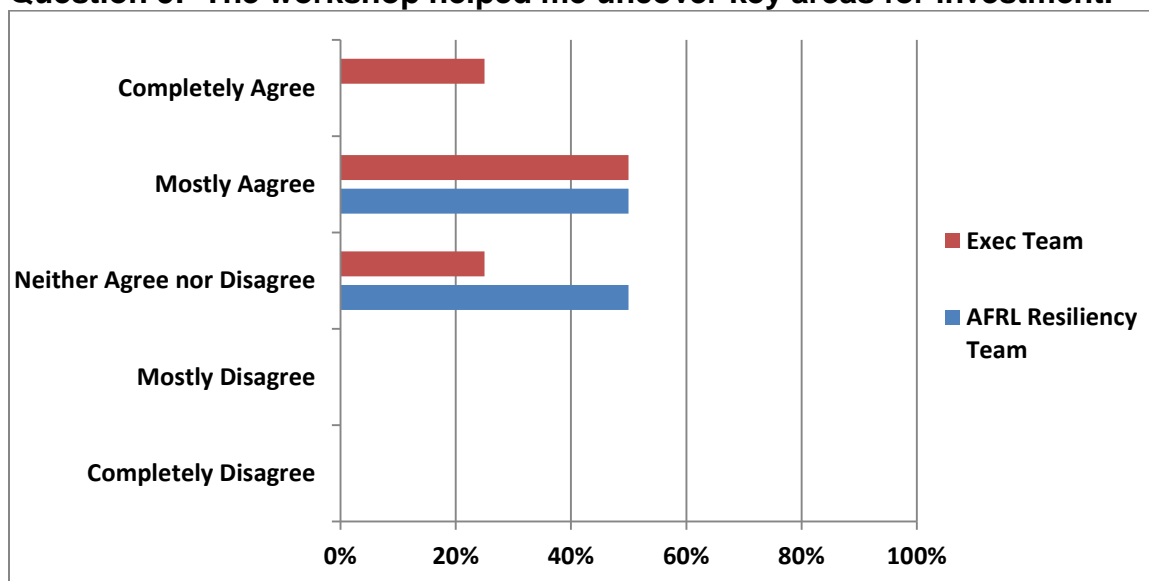
Question 3: There were new research ideas generated from the workshop.



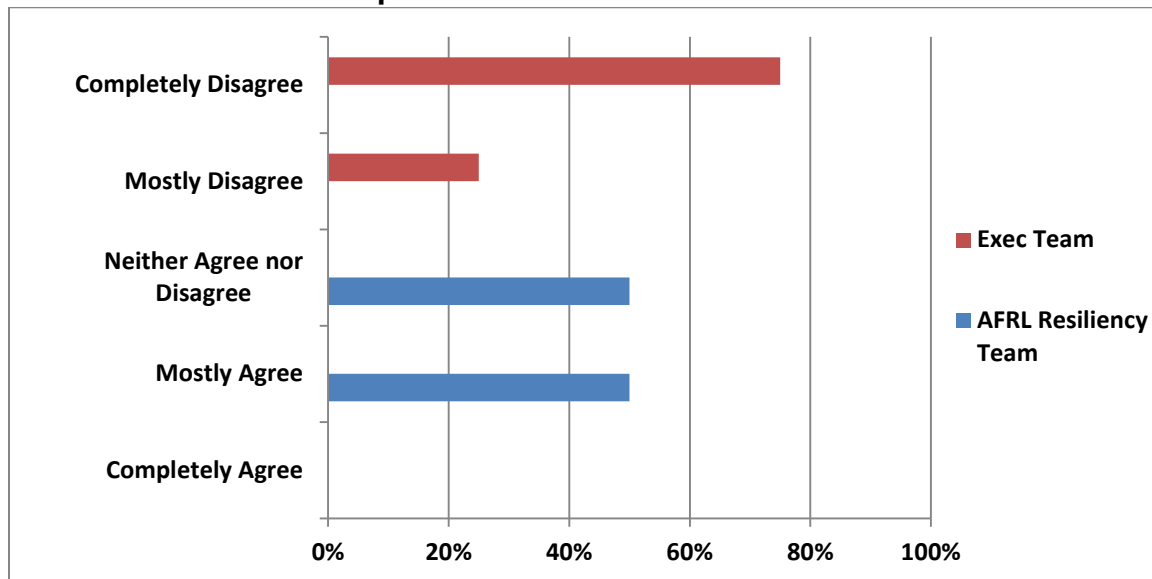
Question 4: Please assess the uniqueness/creativity of the workshop outcomes.



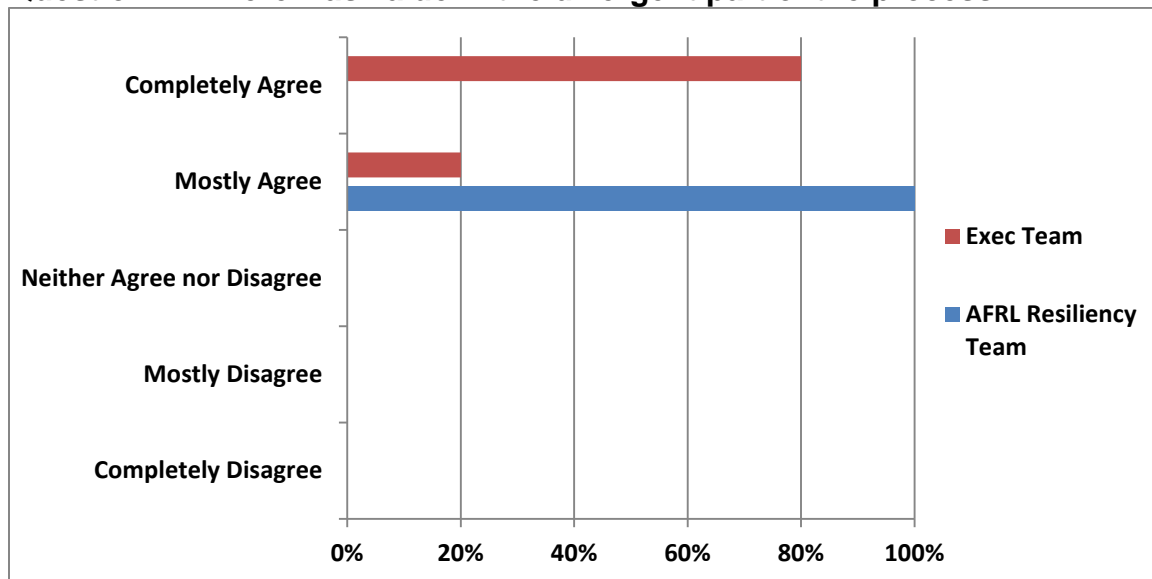
Question 5: The workshop helped me uncover key areas for investment.



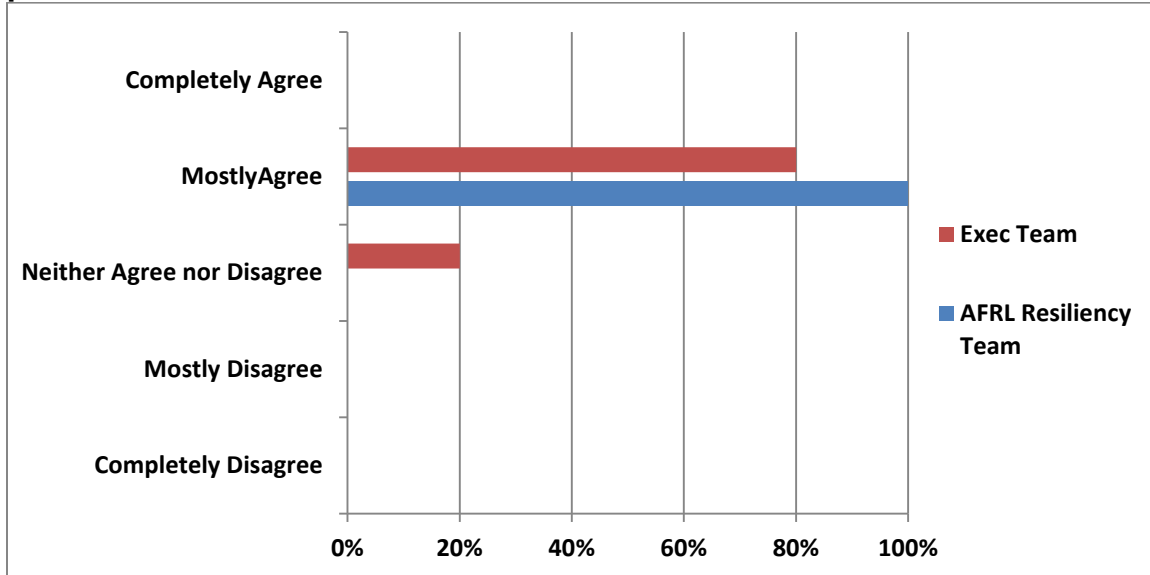
Question 6: I could have achieved the same or similar results without the Divergent CollaborationSM Workshop.



Question 7: There was value in the divergent part of the process.



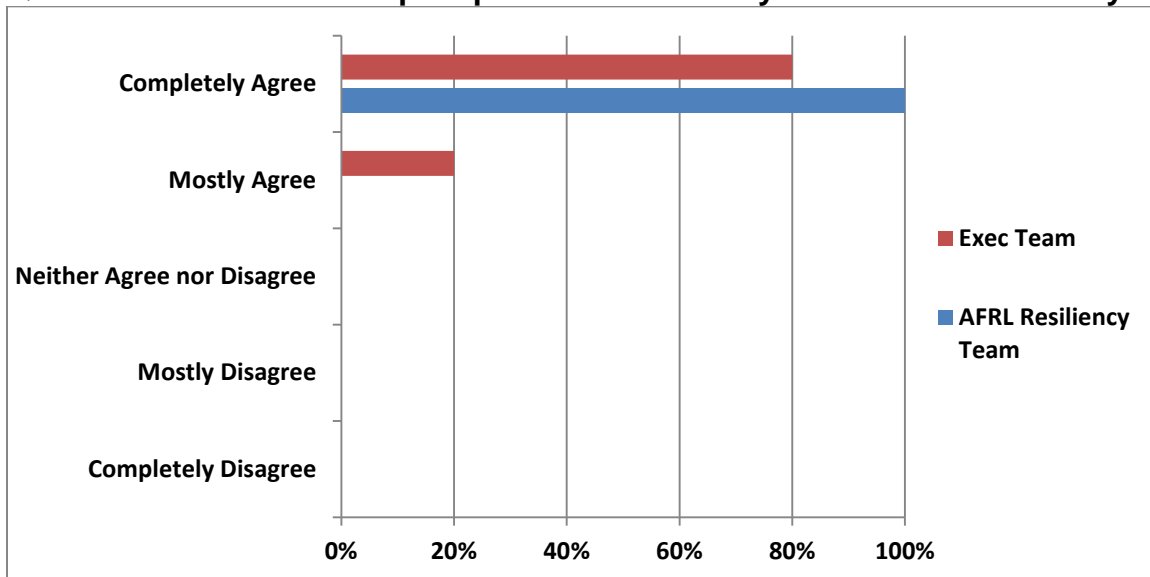
Question 8: The divergent part of the workshop impacted the innovativeness of the products.



Comments from Exec Team

- "Divergent part was important but I don't think "products" were an outcome of the process. However there was an interesting idea raised that I thought was innovative: Can we leverage media addiction to gauge resiliency? Is there a correlation between resiliency and Facebook time?"

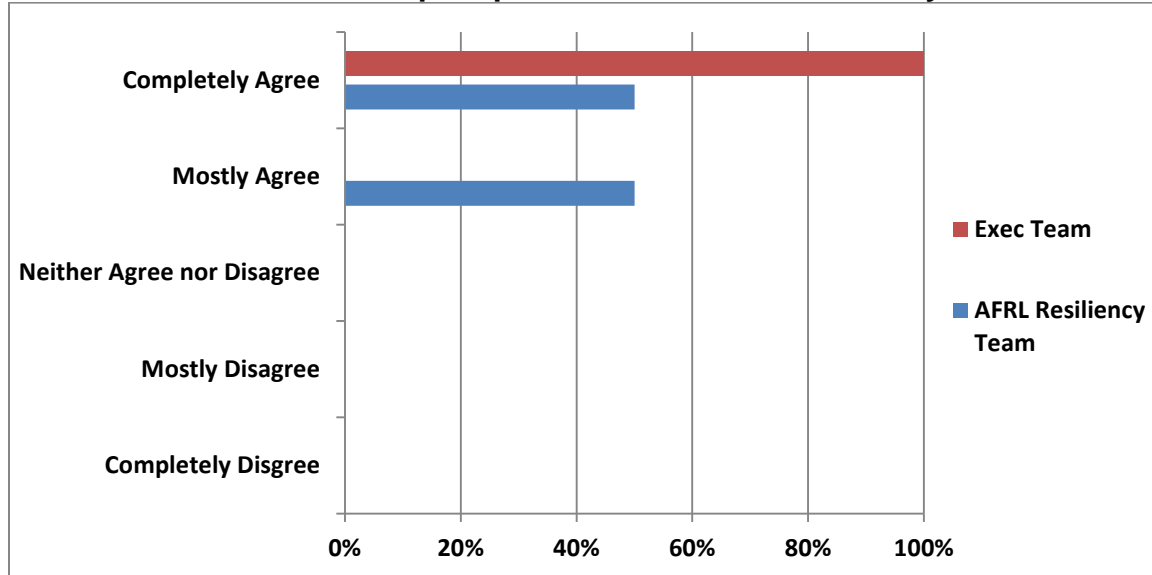
Question 9: The workshop helped me broaden my definition of resiliency.



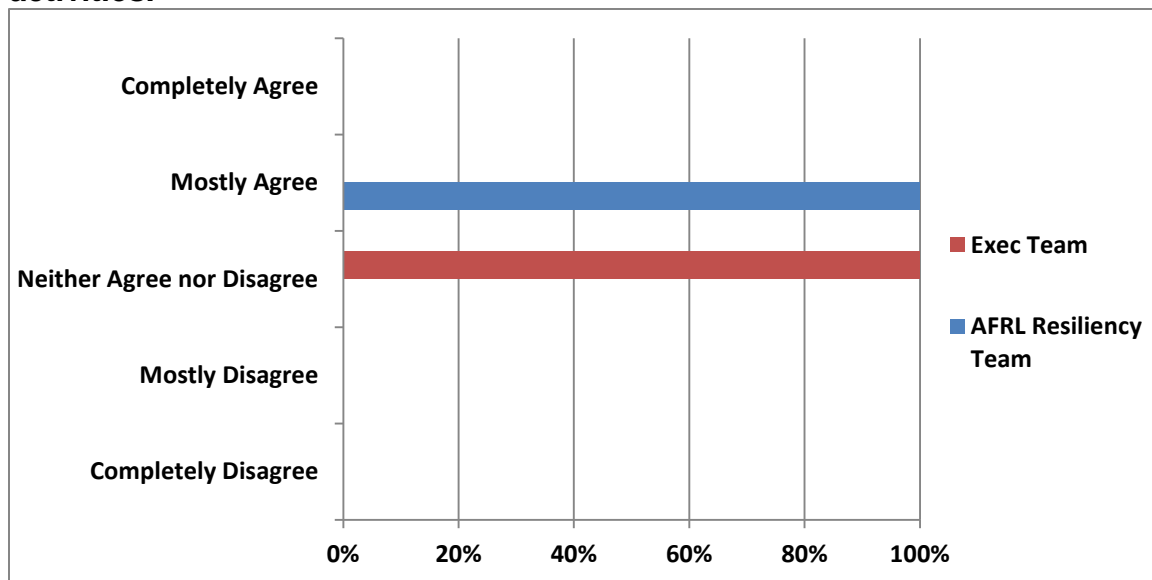
Comments from Exec Team:

- "Think of resiliency like the stock market – sometimes it's up, sometimes it's down, sometimes it's steady-state. Resiliency is a response to change (or lack of change). *Influenced by perceptions."

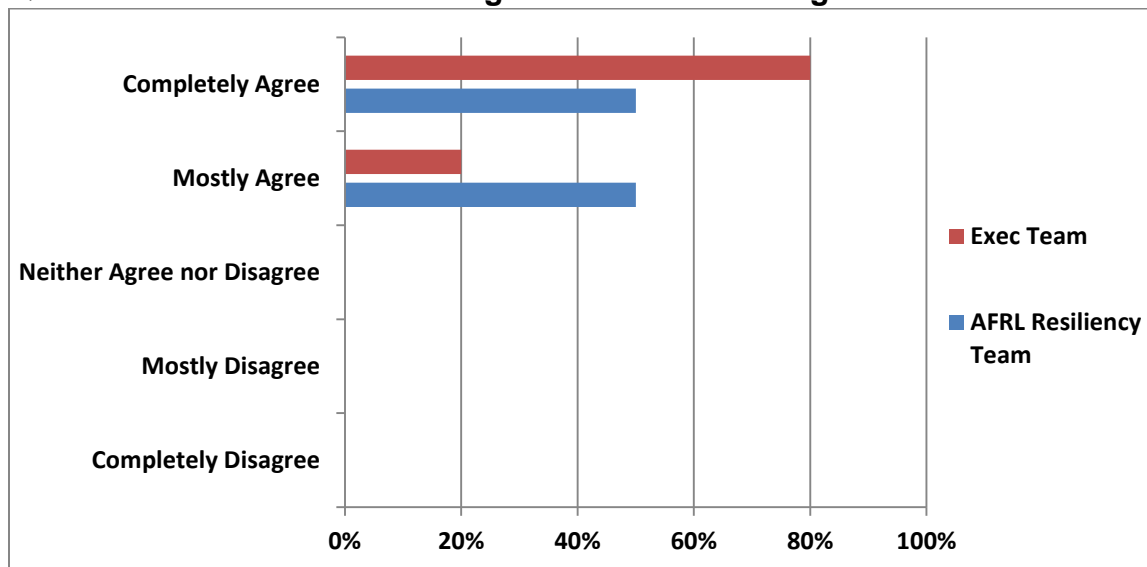
Question 10: The workshop helped me think about resiliency in a different way.



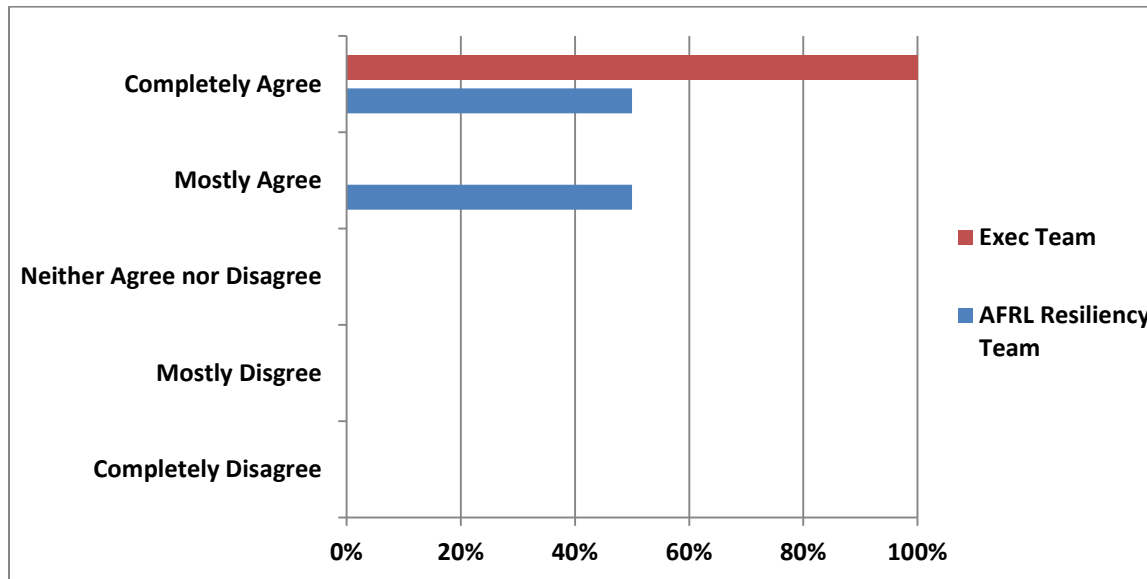
Question 11: The workshop results will impact my future or existing research activities.



Question 12: I would use Divergent CollaborationSM again.



Question 13: I would recommend a Divergent CollaborationSM workshop to other AFRL researchers.



Question 14: What was your overall impression of the Divergent CollaborationSM Workshop?

Comments from Exec Team:

- "A great start"
- "I thought the workshop was productive. It got people talking and thinking in new ways. I have two comments about Kevin's feedback, which was that it served to validate what he already knew:
 1. Validation from such a diverse group of people is a good outcome.

2. Even though it validated the key points, it gave him insight into details that he didn't already have. For instance, he said they already discussed having a mentor's to support returning active duty but he didn't think about what that background and skills that mentor should possess. During the workshop there was a discussion about what type of person would be best suited to mentor from a War-fighter standpoint and it was totally different than what Kevin and Co were thinking.

3. Even though it validated the key points, it helped Kevin reframe some ideas (continuity of Care concept).

4. I think, given his situation, he was leaning toward wanting validation and not starting anything new before he handed off the program."

Comments from POC:

- "I think more time together would be helpful. In fact, several meetings over a couple weeks."
- "Good, there are definitely benefits. I can see it being shorter or shorter sessions over more days (probably not logistically possible)."

Question 15: What changes could we make to improve future workshops?

Comments from Exec Team:

- "No ball throwing – randomly assign numbers on table tents and then go sequentially down with odds, the evens, etc and use different ways to start the sequences for each activity."
- "Perhaps start with a full day and end with a half day. That would mirror the process—spending a day on diverging and a half day on converging (in general)."
- "More time. I felt like the "solution" phase was pretty rushed. I think we could have come up with better ideas with increased amount of time."

Comments from POC:

- "Greater facilitator control over break outs"

Question 16: Comments and/or Suggestions

Comments from Exec Team:

- "Stronger coffee."

7.7. Appendix G – Demographic Information for HPA Participants

Gender

- | | | |
|----------|---|-------|
| • Female | 6 | (46%) |
| • Male | 7 | (54%) |

Age:

- | | | |
|-----------|---|-------|
| • 20-29 | 1 | (8%) |
| • 30-39 | 4 | (31%) |
| • 40-49 | 2 | (15%) |
| • 50-59 | 3 | (23%) |
| • Over 60 | 3 | (23%) |

Education:

- | | | |
|------------------------|---|-------|
| • Post Master's Degree | 7 | (54%) |
| • Master's Degree | 2 | (15%) |
| • Undergraduate Degree | 2 | (15%) |
| • High School Diploma | 2 | (15%) |

7.8. Appendix H – Comprehensive List of Ideas from the HPA Group

1. Wild Ideas

- Stimulating brain/body
- Acupuncture/acupressure
- Measure electromagnetic Aura
- Use hypnosis
- Measure Non-traditional Human Energies
- New paradigm for conops
- Train to induce vivid imagination
- Holistic Approach
- Personalize the job
- System technology changes
- Prevention
- Intentional Distraction
- Openness to new outside ideas
- Use monitoring data to augment performance capability

2. Actionable Research

- Spiritual, social, cognitive, extraordinary (beyond the science)
- Is the human the best performer?
- Put person in crisis
- Change context for operation
- Make performance need personal
- Make performance personal
- Examine best practices then apply
- Problem solving vs. blaming
- Flexibility in approach
- Rotation
- Finding place of most disruption
- Molecular, biological, sensing R&D
- Finding trends
- Human awareness

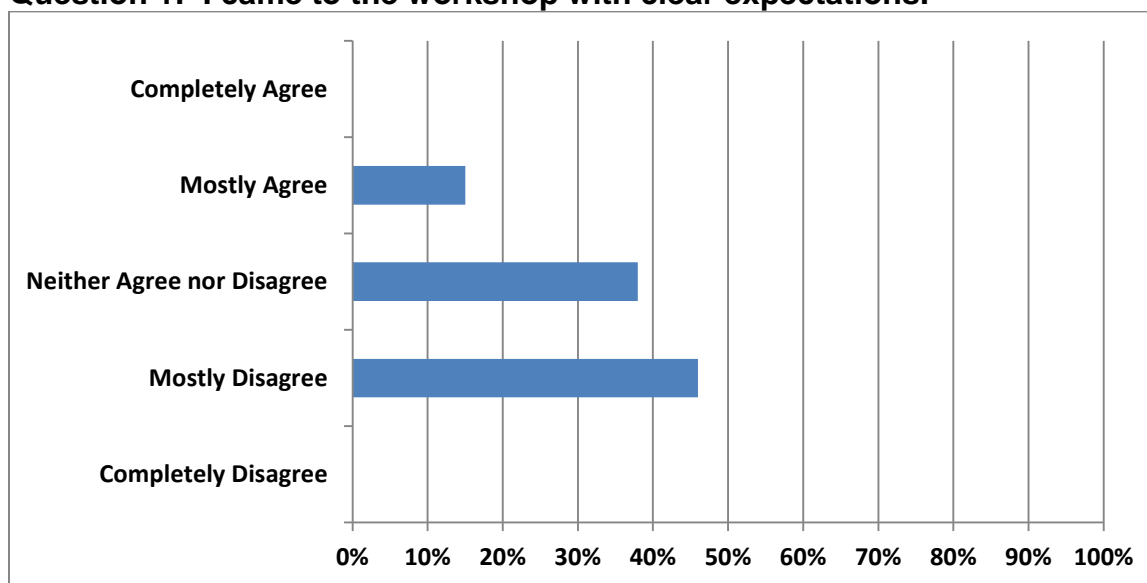
- Practical Assessments
- Assessing individual baseline for “work”
- Non-intrusive assessment
- Examine situations that lead to HPA
- Incentive for baseline and high performance
- Physical fitness and HPA R&D
- Mental exercises to increase HPA
- Individually derived incentive
- Personal reward/motivation approaches to HPA
- Specific environment conditions to achieve HPA (atm, audio, music, senses)

3. Products

- Tone changes to maintain alertness
- Stress Assessment with heightened alertness
- Functional movement screen
- Cycle measurement and application
- Daily objective and feedback tools
- Eye, ear products
- Zero error “program”
- Screen moving with operator
- Team monitoring with feedback
- Nutrient pumps to enhance performance
- Automatic throttling of information base on ability

7.9. Appendix I – Summary of HPA Process Questionnaires

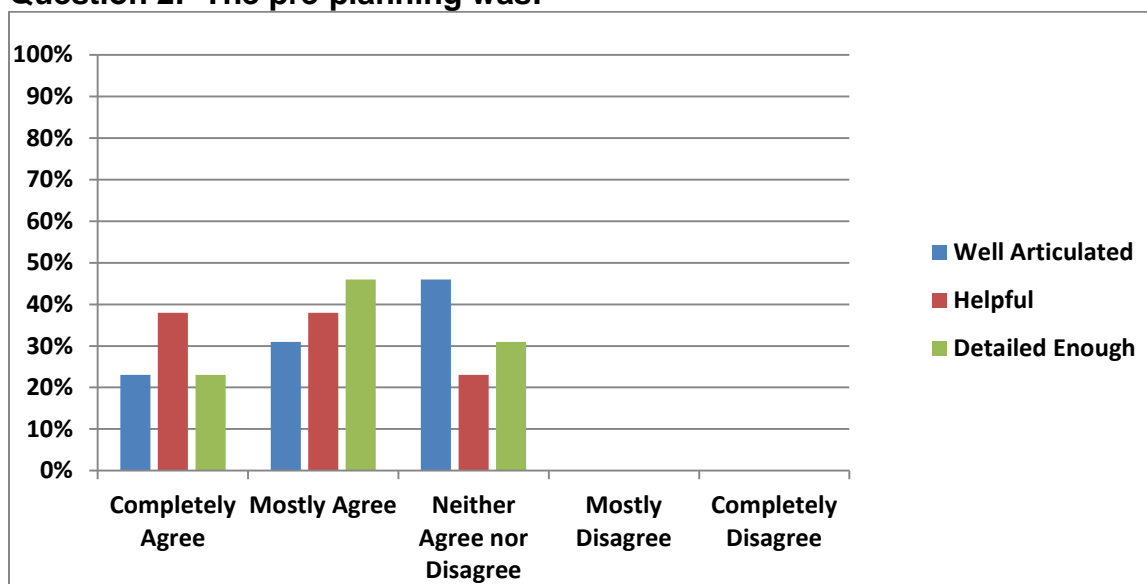
Question 1: I came to the workshop with clear expectations.



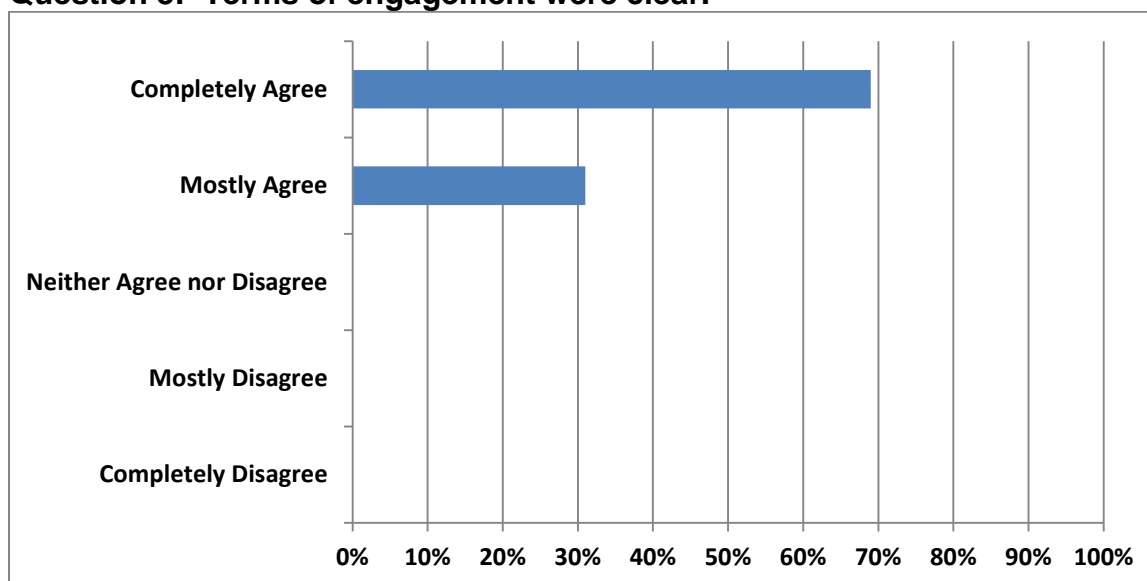
Comments from participants:

- “This was on purpose”

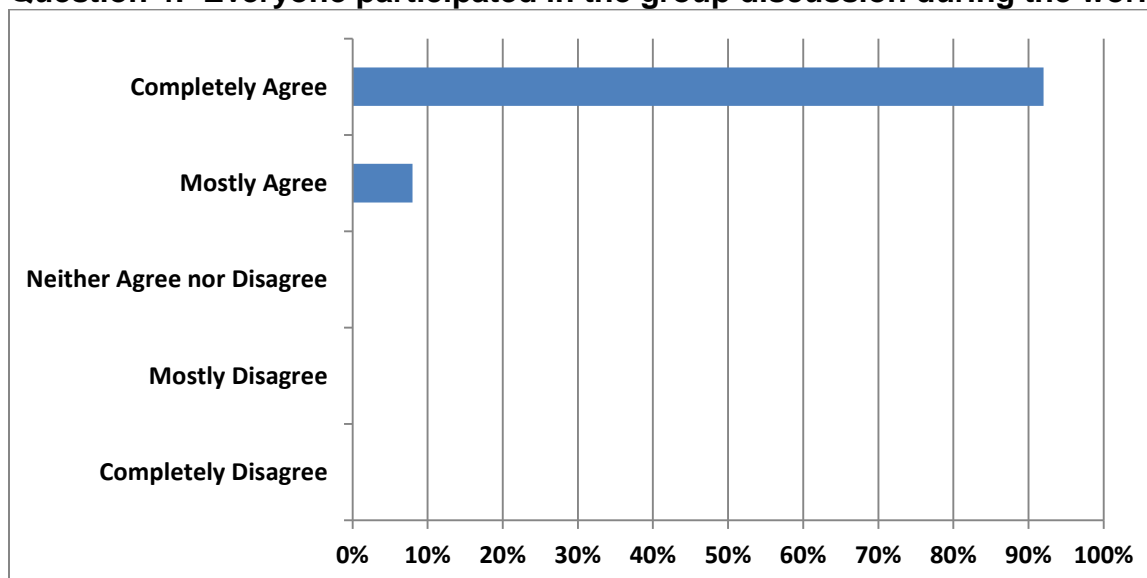
Question 2: The pre-planning was:



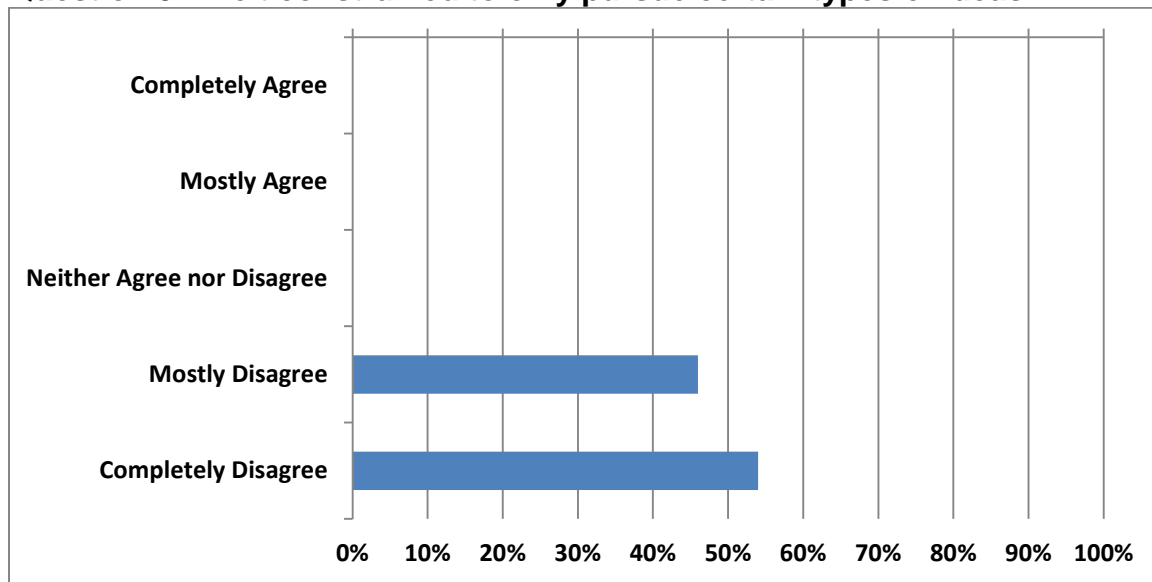
Question 3: Terms of engagement were clear.



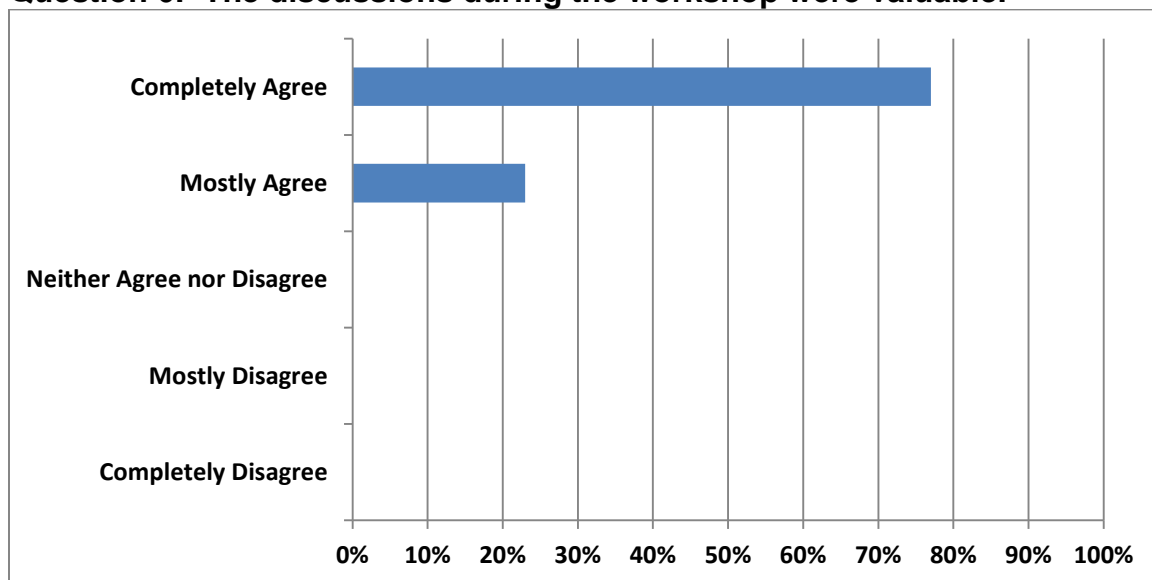
Question 4: Everyone participated in the group discussion during the workshop.



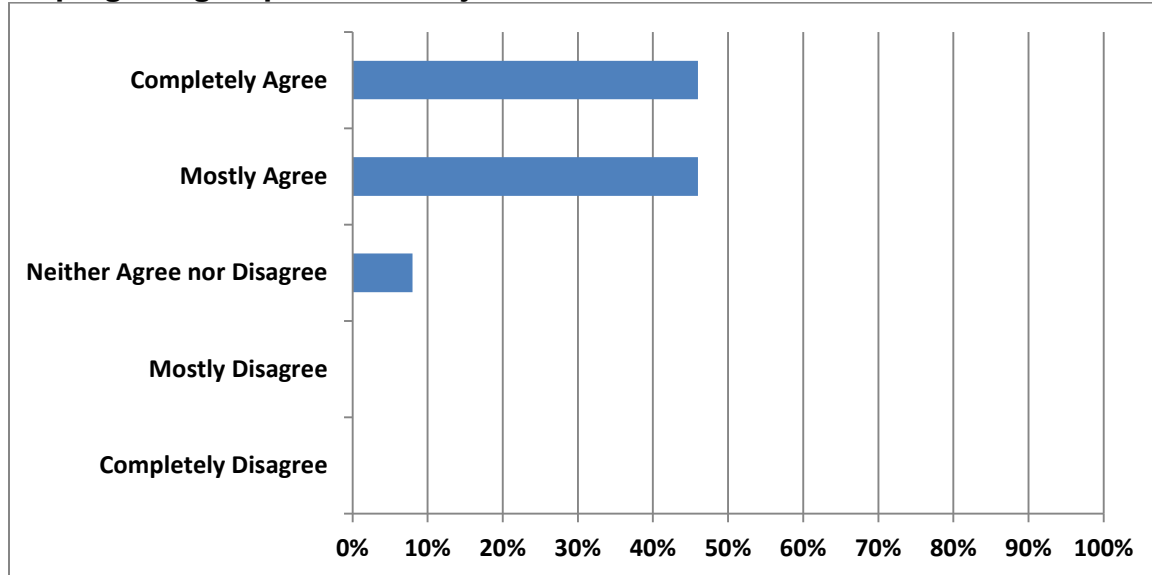
Question 5: I felt constrained to only pursue certain types of ideas.



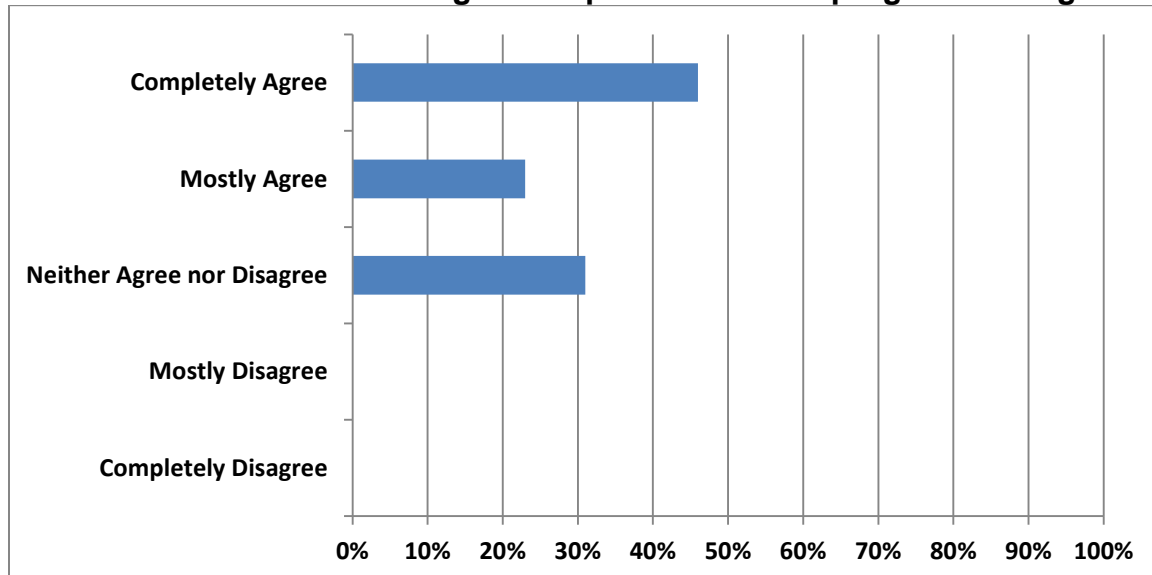
Question 6: The discussions during the workshop were valuable.



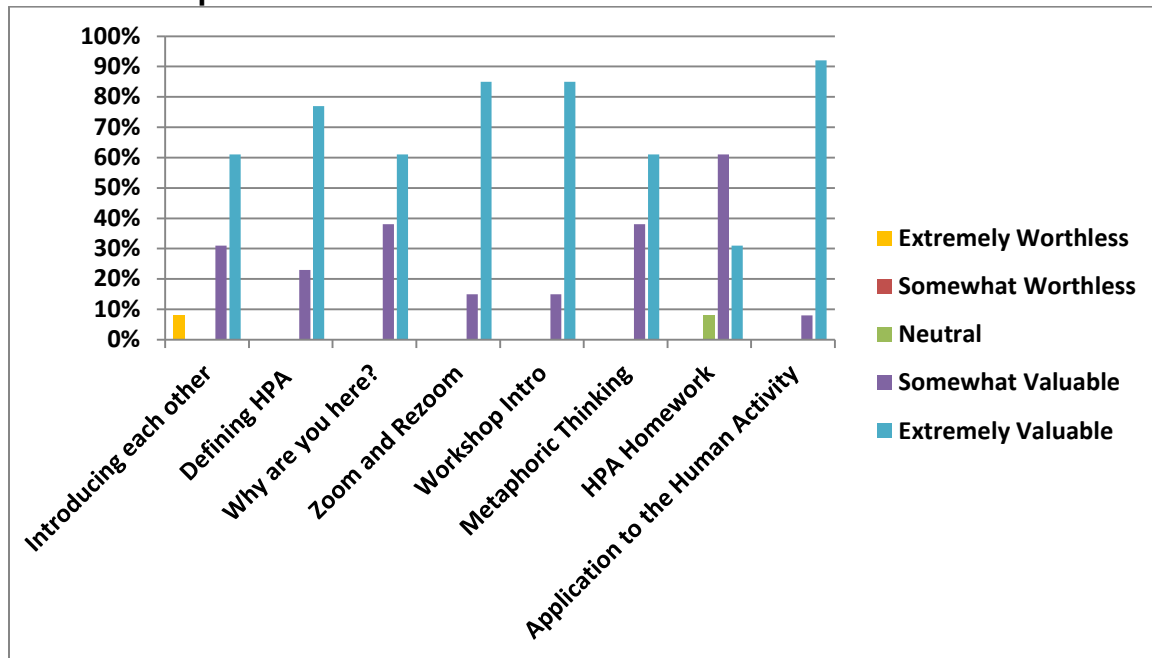
Question 7: The process and activities used in this workshop were essential in helping our group meet its objective.



Question 8: The Process Diagram helped me to track progress during the workshop.



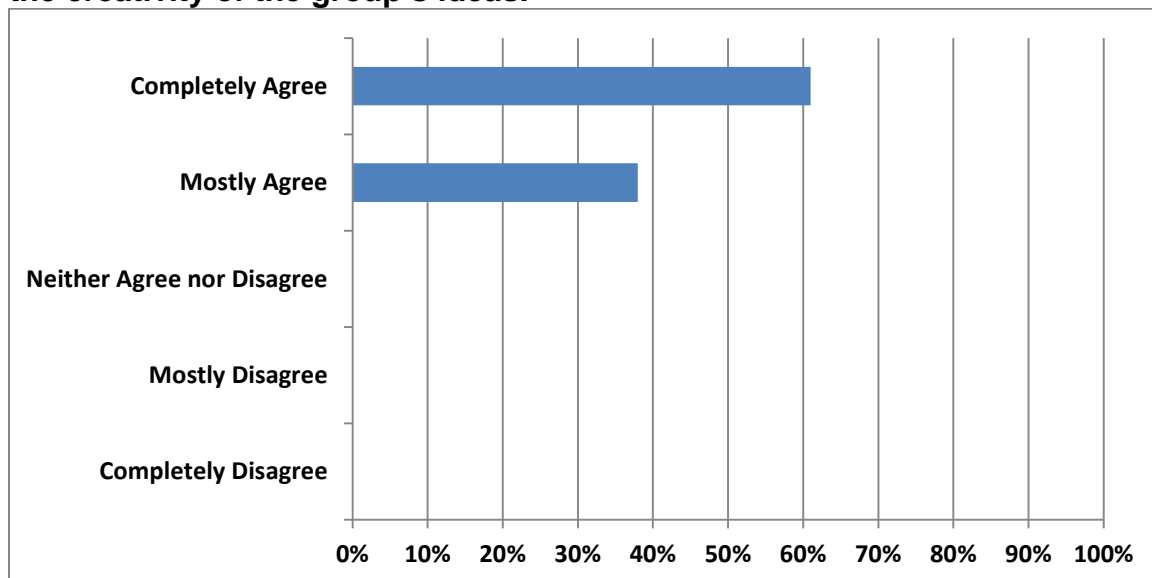
Question 9: Rate the activities below in terms of if you think they were valuable to the workshop.



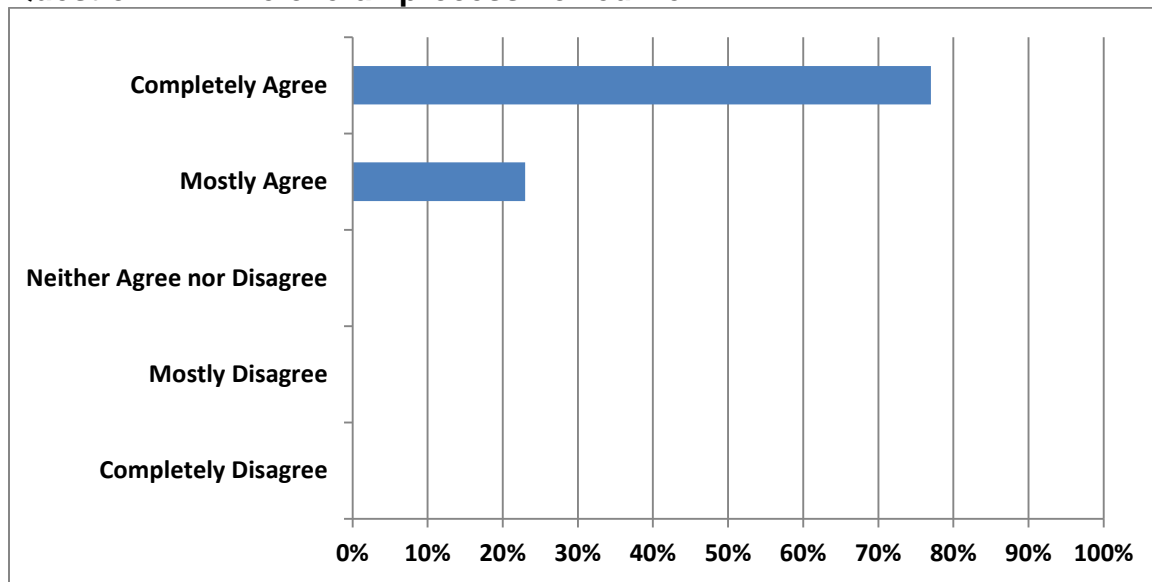
Comments from participants:

- “The introduction was not interesting or valuable.”

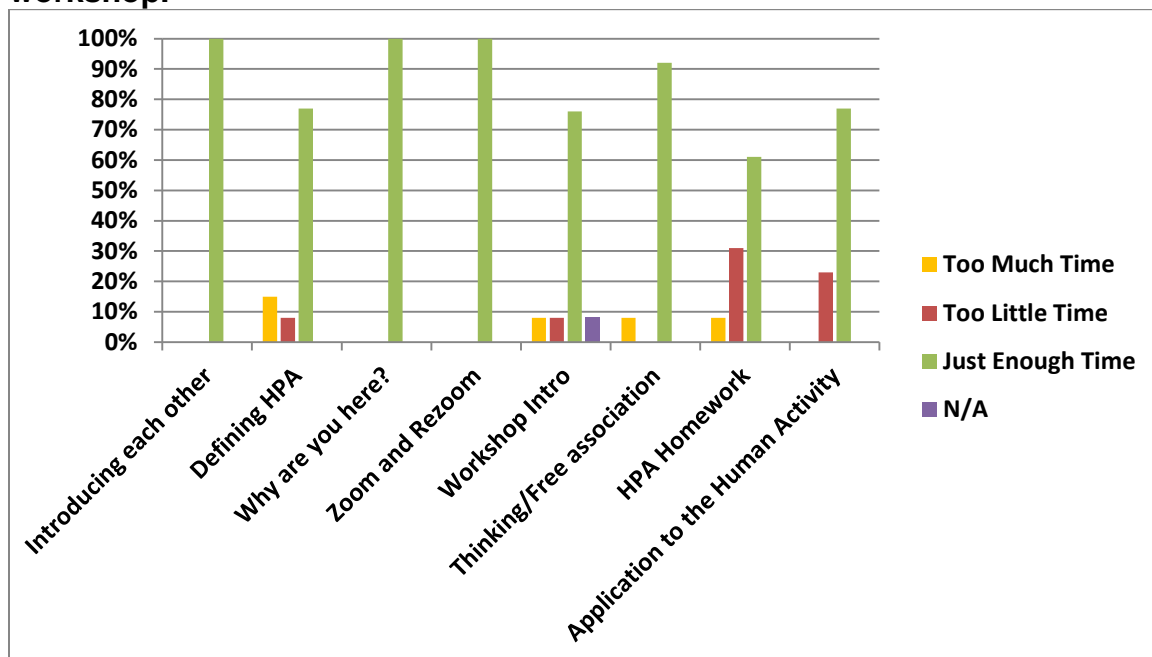
Question 10: The process and activities used in the workshop significantly enhanced the creativity of the group’s ideas.



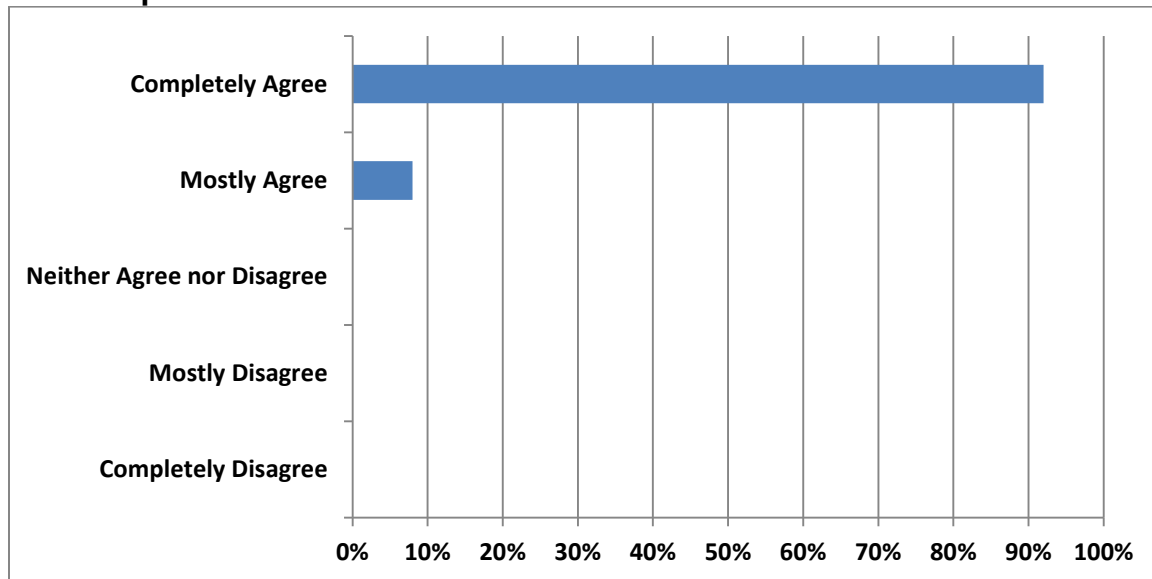
Question 11: The overall process flowed well.



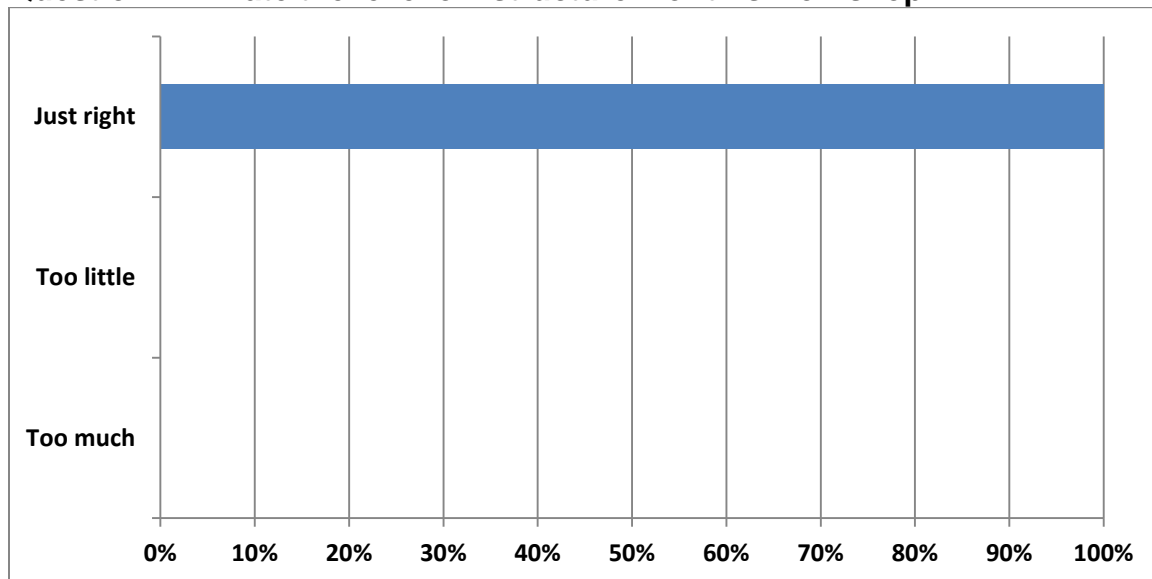
Question 12: Rate the length of time spent in each of the following areas during the workshop.



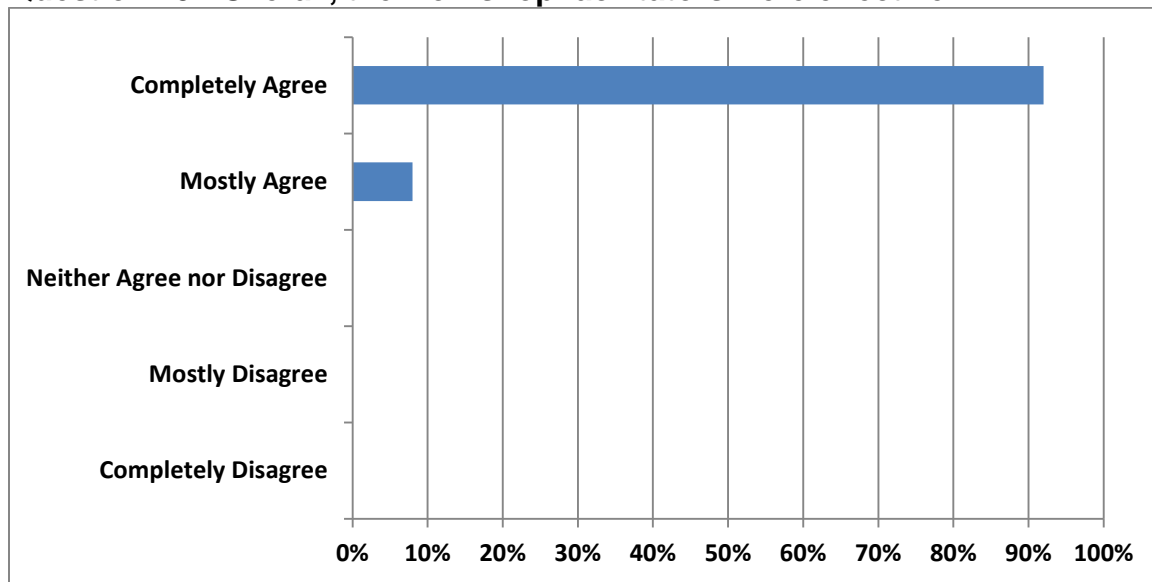
Question 13: The group took full advantage of the activities introduced during the workshop.



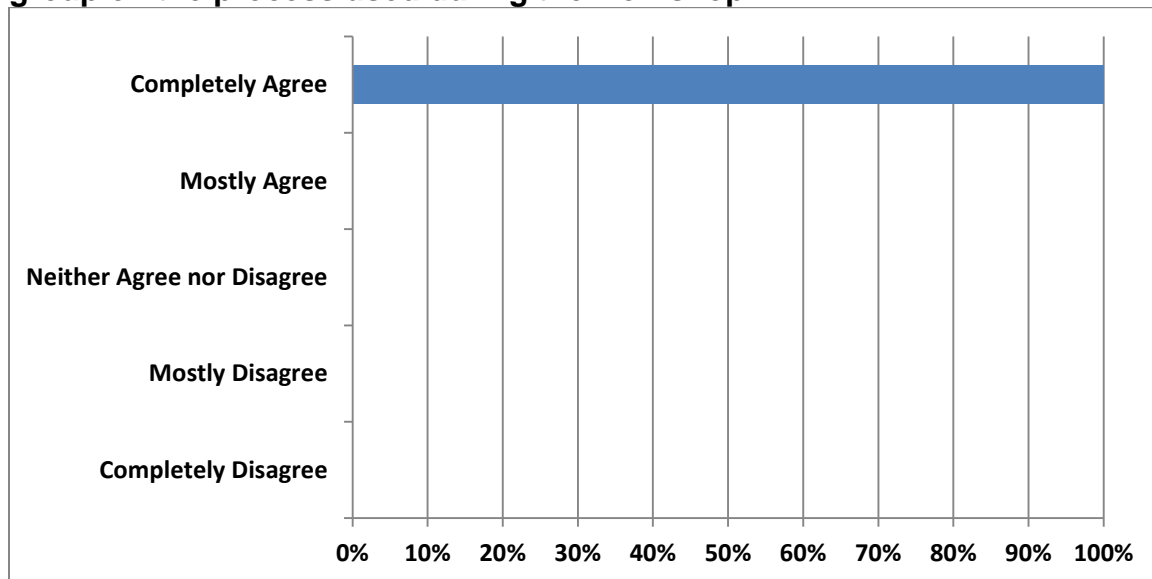
Question 14: Rate the level of “structure” for this workshop.



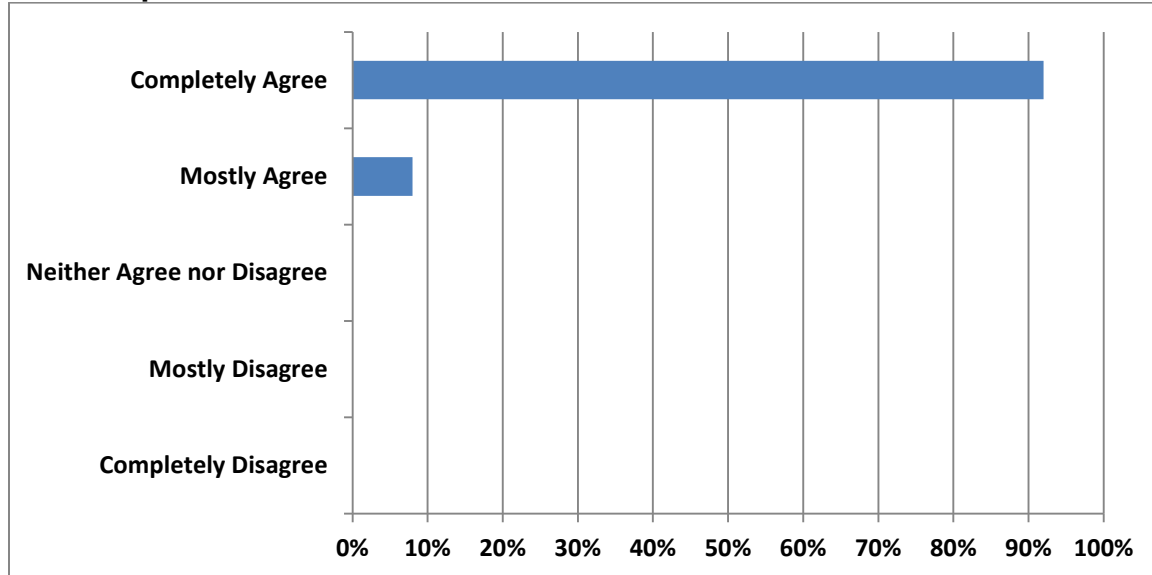
Question 15: Overall, the workshop facilitators were effective.



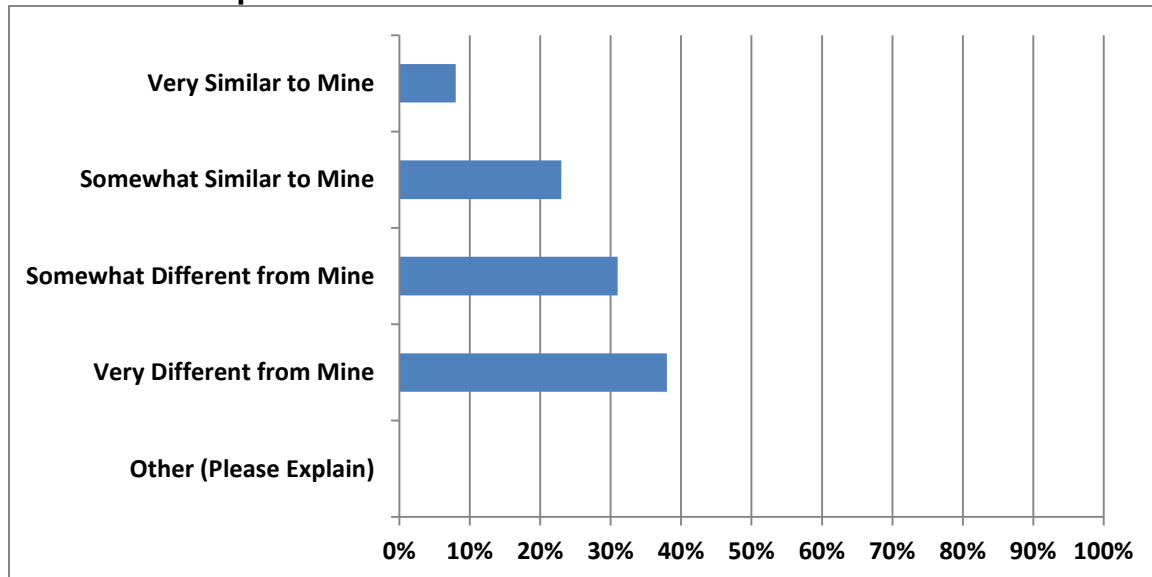
Question 16: The workshop facilitators had sufficient knowledge to instruct our group on the process used during the workshop.



Question 17: The workshop facilitators answered questions effectively during the workshop.



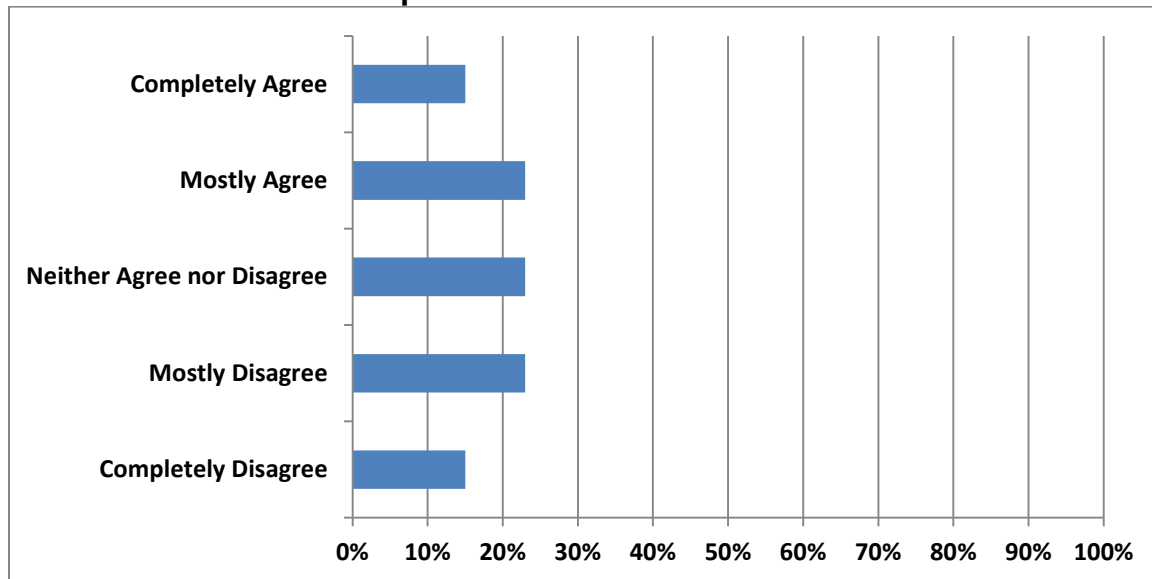
Question 18: Describe your area of specialization as compared to the other members of the workshop.



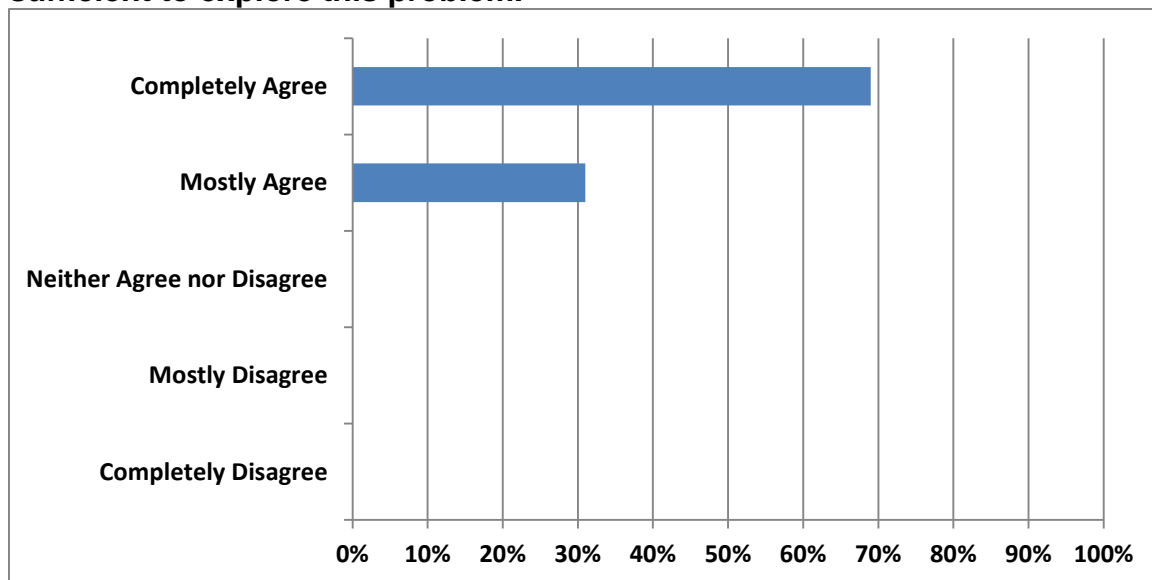
Comments from participants:

- “Some were very different from mine.”

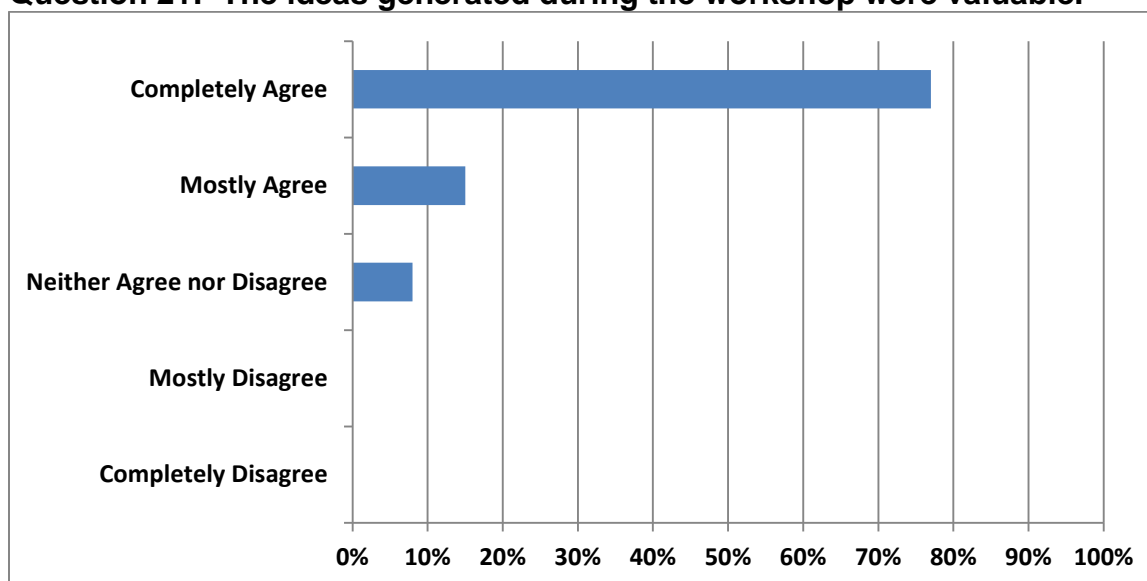
Question 19: I had a great deal of prior knowledge/expertise on the topic/problem we examined in this workshop.



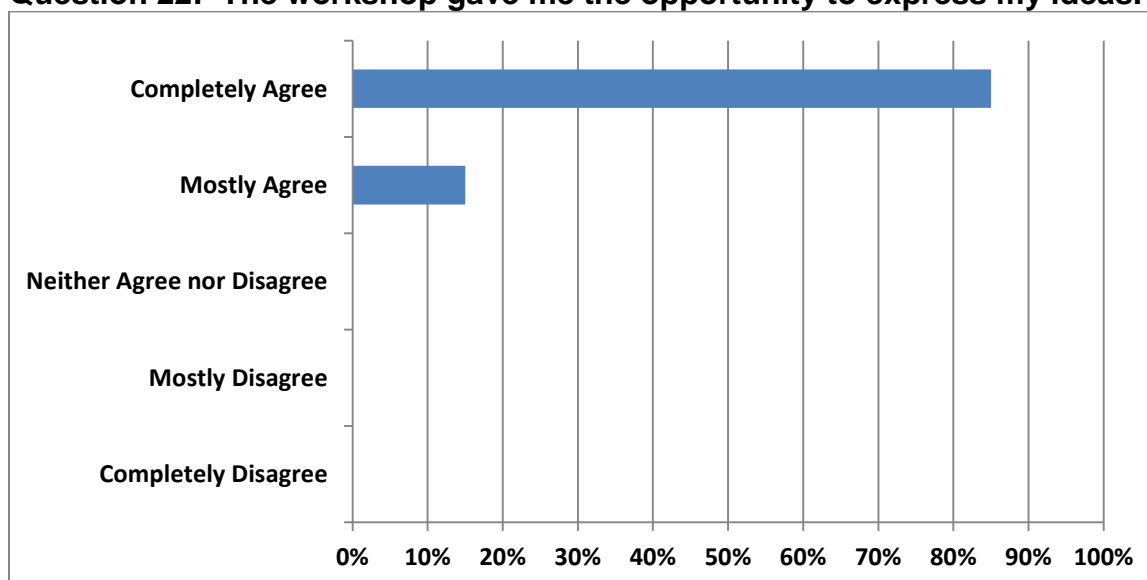
Question 20: The knowledge and experience of the workshop participants were sufficient to explore this problem.



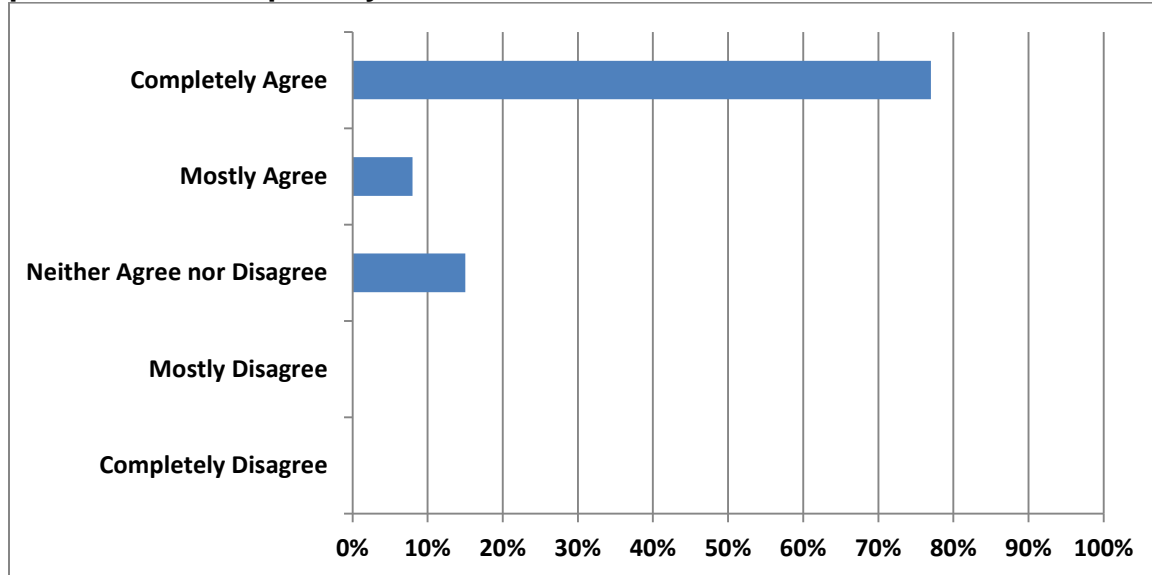
Question 21: The ideas generated during the workshop were valuable.



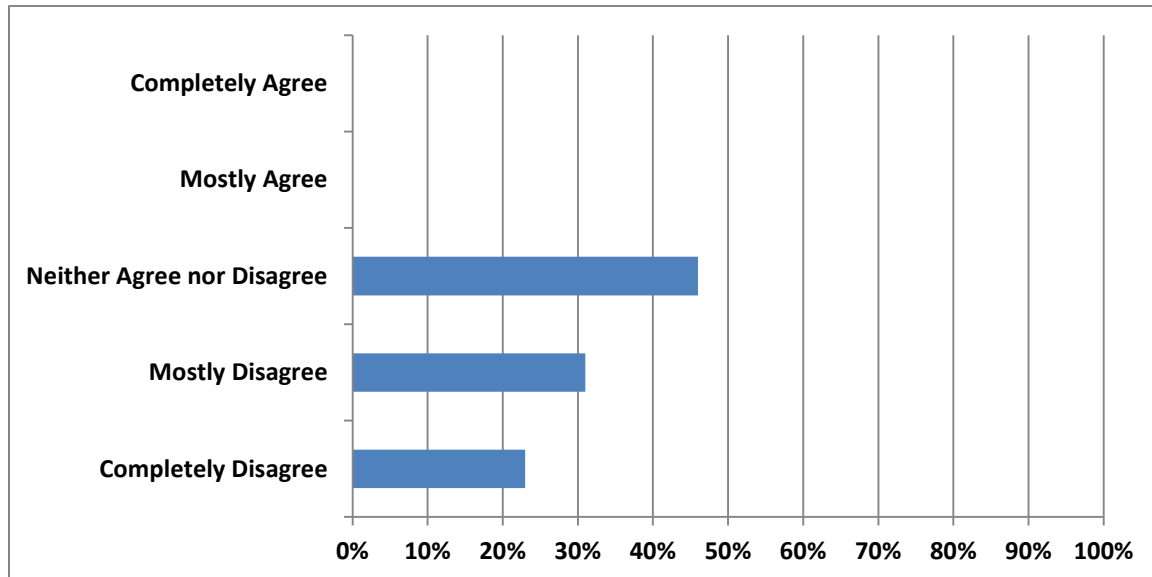
Question 22: The workshop gave me the opportunity to express my ideas.



Question 23: At one or more points during the workshop, the group approached the problem in a unique way.



Question 24: In looking back, I believe there were ideas that our group overlooked/dismissed.



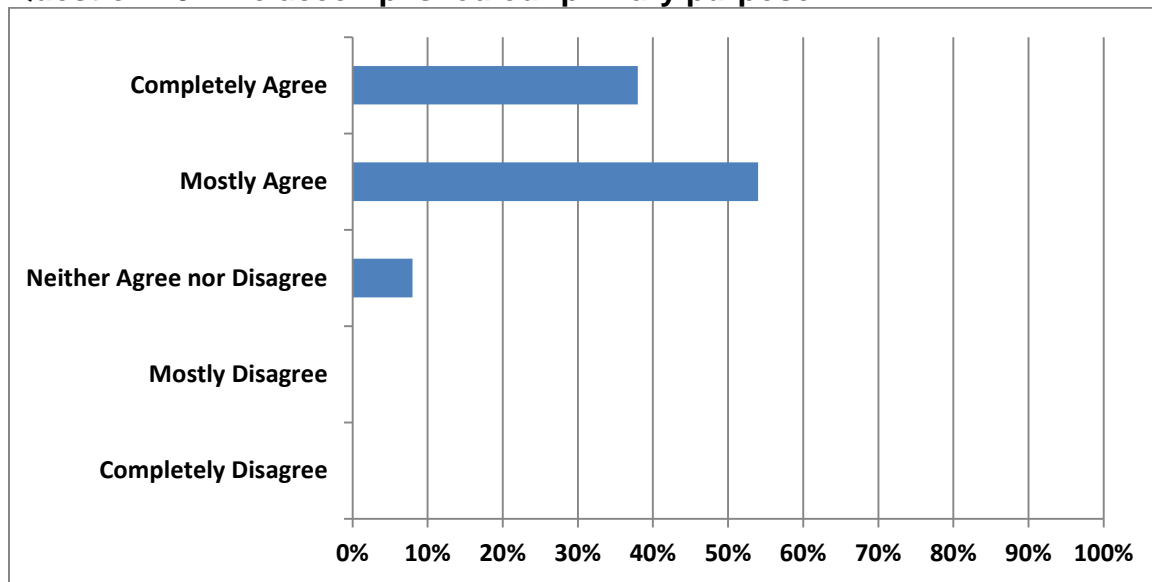
Comments from participants:

- "Always possible to find new approaches and thoughts."

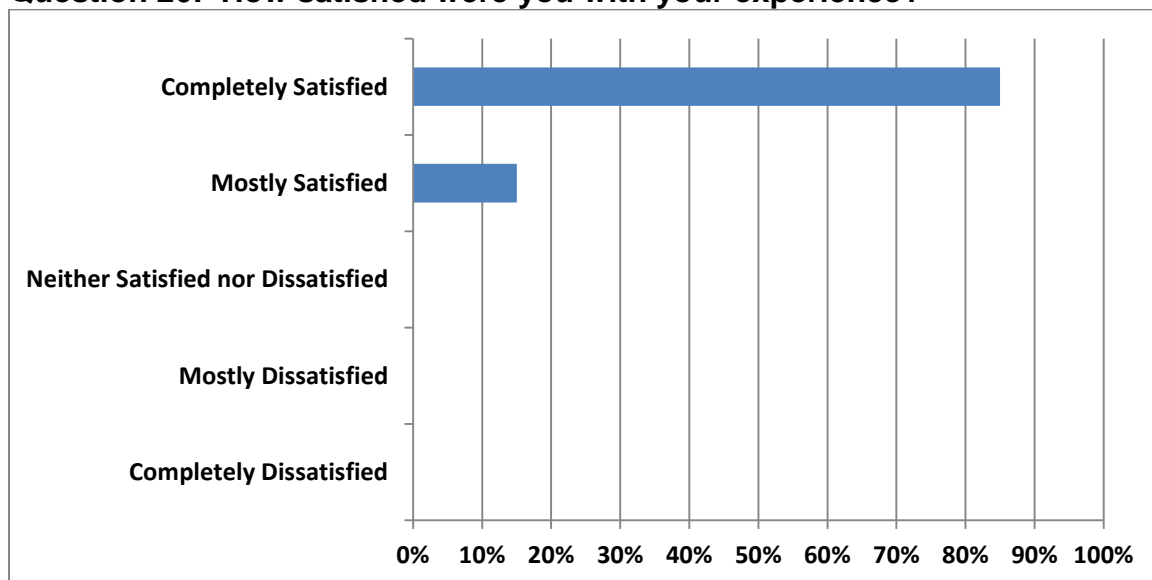
Comments from POC:

- "Very broad topic; hard to cover it all."

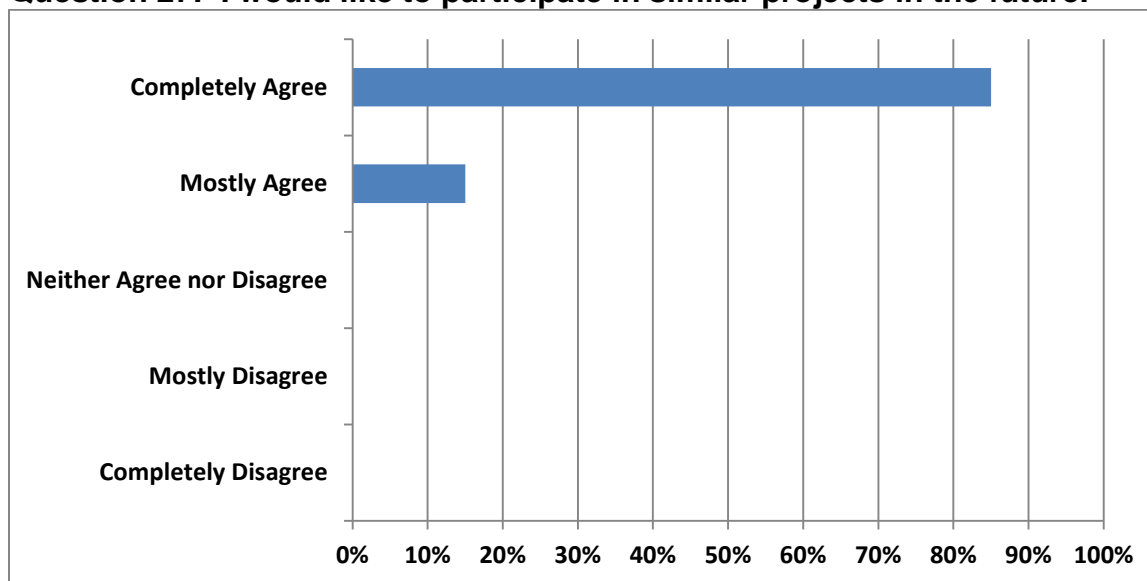
Question 25: We accomplished our primary purpose.



Question 26: How satisfied were you with your experience?



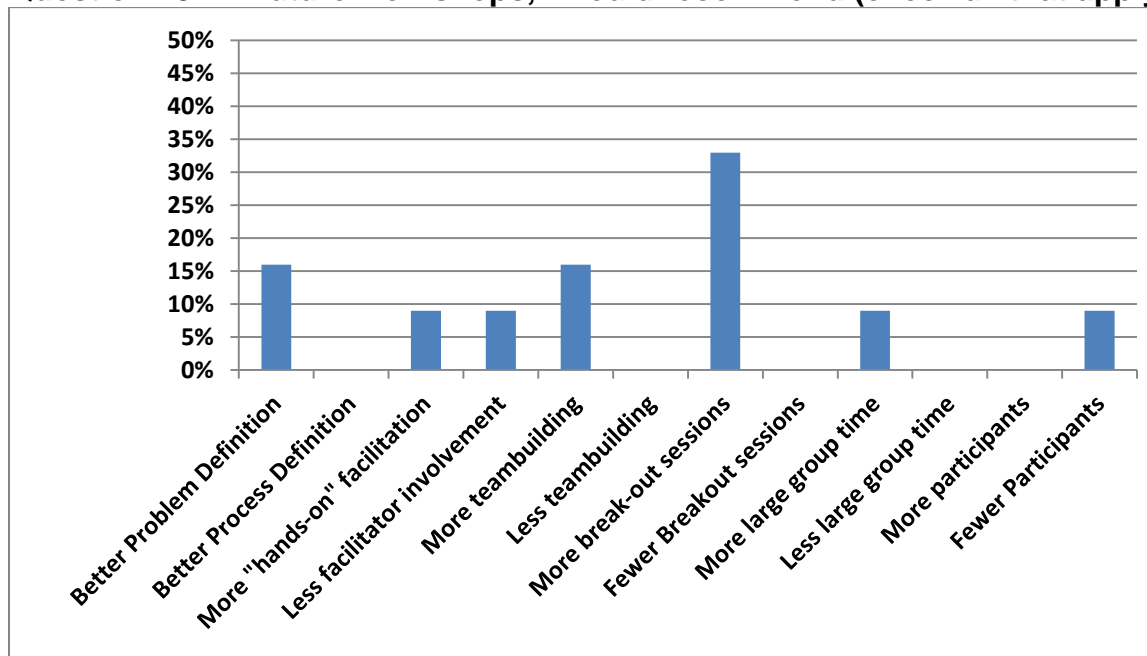
Question 27: I would like to participate in similar projects in the future.



Comments from POC:

- "Depending on topic."

Question 28: In future workshops, I would recommend (check all that apply):



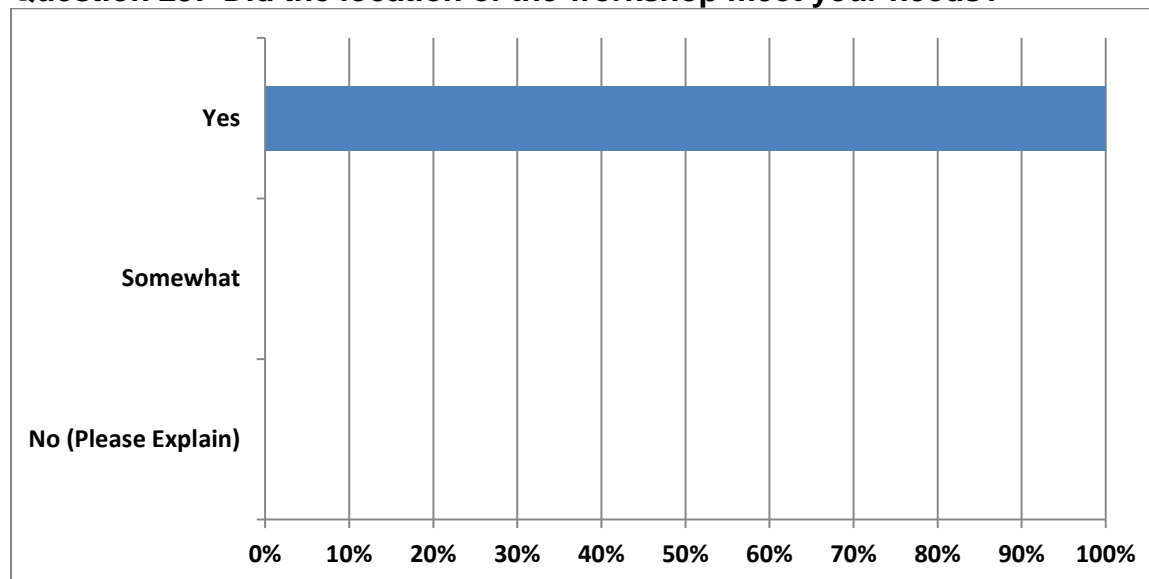
Comments from participants:

- "Better define what issues and situations need to be addressed."
- "I thought it was all just right."
- "Very few changes. Good group size—functional."
- "Right amount of time in each task/section"

Comments from POC:

- “All seemed very good for this workshop.”

Question 29: Did the location of the workshop meet your needs?



Question 30: What activities did you like most/least?

Which activities did you like most/least?

Participant Comments:

MOST

- “Open discussion, small group activities, zoom/re-zoom”
- “Small group/word association/analyses of topics and ideas”
- “I enjoyed every exercise; zoom/re-zoom was interesting”
- “I liked learning about each other and the break-out sessions.”
- “Zoom/re-zoom”
- “Zoom/re-zoom was an excellent exercise on teamwork, collaboration, perspective”
- “Zoom”
- “Zoom/re-zoom”
- “Zoom/re-zoom; whole group worked together as a team; respectful of one another- able to complete the task in an orderly manner; reached goal”
- “Zoom/re-zoom; introductions, metaphoric thinking and word associations”

LEAST

- “Converge did not follow small group time. Ideas were lost by not having smaller groups generate thoughts.”
- “Diverge break-out”

POC Comments:

- “All seemed important- good blend of small group and large group activities.”
- “Zoom/re-zoom and getting to know the team; I would have liked one more small group.”

Question 31: What was your overall impression of the Divergent CollaborationSM Workshop?

Participant Comments

- “I am *extremely* impressed. This has been a fascinating day and a half. Though I didn’t know what to expect coming in, I leave with a high regard for the process of Divergent CollaborationSM and the power of this process.”
- “Love different points of view looking at situations/seeing how they tie together and add my original thoughts/perspectives. Very interesting.”
- “I thought the workshop was very effective; however, I think it is too short to propose ideas to such a complex issue. Would have liked to have more time to discuss ideas- also would have liked to have known specifically what solutions have been attempted to avoid duplication or improve existing potential ideas”
- “I thought it all worked together great. Good pacing of group building and exercises. Great facilitating and keeping on task and “in the moment.” Enjoyed break-outs with different people, different facilitators would have been good for me as well (I had Rachael both times). Great process and I enjoyed a “cutting edge” experience.”
- “Very interesting method and idea of bringing various backgrounds together. Could have lots of potential in helping some organizations.”
- “I enjoyed the group, process and topic.”
- “Interesting, fun, educational, free-spirited, diverse group, accepting, encouraging, out of the box.”
- “It was a fascinating, stimulating experience. I could not gain a sense of whether we provided value to AFRL, but it certainly was a valuable experience for me.”
- “This was a very well thought-out, structured, and executed workshop that I feel very lucky to have been able to take part in. It was mutually beneficial for most participants because we all learned techniques/gained advice from other participants, and we were able to provide “out-there” concepts/ideas to AFRL.”
- “I enjoyed working on the project. It allowed me to look at things from my perspective as well as think outside of the box. Realizing that things one person does on a daily basis that is routine to him/her can actually be beneficial to someone else in a totally different field. I love the concept of this type of collaboration.”
- “The concept was impressive. To be open to utilize very different areas of expertise and experience to solve specific problems is something not normally done. This is a great example for other industries to use the concept to solve various internal problems by utilizing unrelated/related sources.”

POC Comments:

- “Came into it without much knowledge of the process, and a general dislike of thing like this, but walked away with a very positive experience. Very good method for thinking outside the box and would recommend for future programs.”
- “Group was open and helpful, communicated well and respectful. Team leaders guided, translated, and facilitated excellently. We came together as a diverse group to address/discuss a problem on HPA.”

Question 32: What changes could we make to improve future projects?

Participant Comments:

- In hindsight I realize an observer might learn as much from the process as from what he produced. Much is to be gained for what is learned about how our divergent group worked together. This alone has value. Perhaps we all had a “product-centered” expectation, so it’s tough to know how successful we were. However, I also hope something was gained by how our group approached the process.”
- “Clearly define issue or situation at convergence part of workshop. What AFRL is trying to address with HPA still not clear to me. Hard to suggest new thoughts when I don’t know the issue.”
- “Need more time to get into the problem. Two days for Group Dynamics and understanding Divergent CollaborationSM and three days to get into the Idea Phase- should propose ideas for each human context. For example, Day 1: Intro/Group and Team Exercise, Day 2: Explain and Experience Divergent CollaborationSM, Day 3: Social/Tech/Biological, Day 4: Cognitive/Physical/Environmental, Day 5: Spiritual, wrap-up, and admin”
- “None come to mind at this time.”
- “You’re doing very well. I really liked the way Bart and Candace interact. More racial/ethnic diversity would be an addition.”
- “After problem evaluation, team building, etc. Might spend a bit more time on solution discussion and focus a bit more to achieve value to AFRL.”
- “Maybe having the team members develop a “topic sentence” for relating themselves/their careers together to show the overarching commonality (experiences). Keeping the group better focused and quicker recognition of when the evaluation of ideas started occurring. Making sure introverted people are truly getting heard.”
- “During the break-out sessions, I was with the same facilitator each time. May help increase creativity if the individual groups have different people as well as different facilitators.”
- “Continue to think outside the box in selection of participants and divergent areas of profession, expertise, and experiences.”

POC Comments:

- “Make an attendance list with very brief bios to help make connections.”
- “I hope ideas are captured so we may be able to use them. Stop us/change us from a specific application/conop sooner. Stop us from talking too long on one application. Steer us to wild thinking. Overall group seemed conservative.”

Question 33: Comments and/or Suggestions.

Participant Comments:

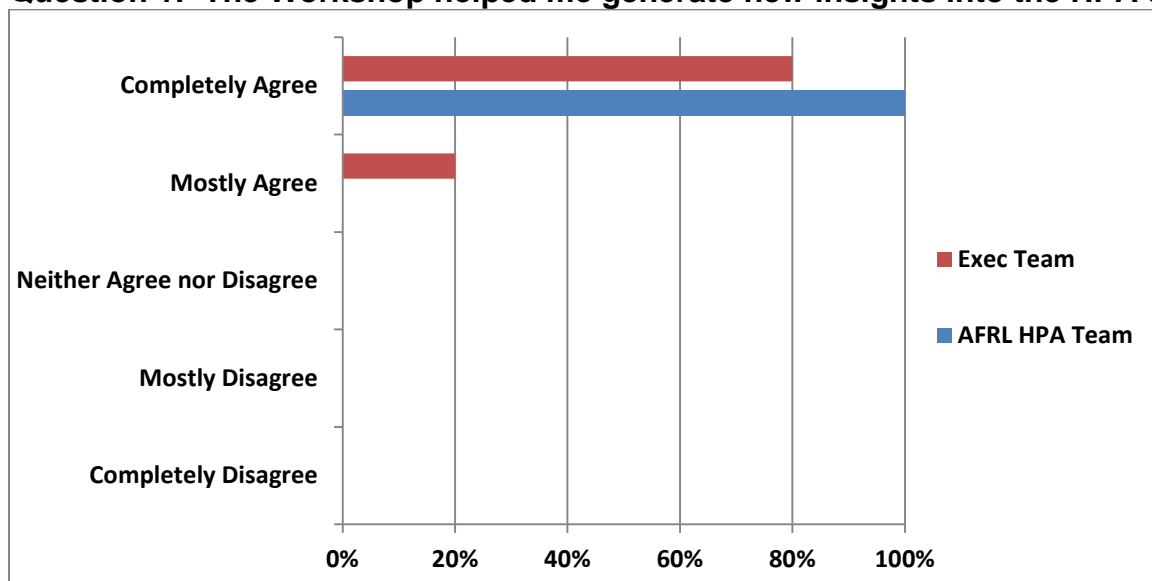
- “There are many applications for those types of events in our business, academic, artistic, and scientific communities. The WBI was unknown to me before this point. I hope to work with you again, not only in this context, but in the context of other organizations in the Dayton community as well. Thank you!”
- “Thanks!”
- “Exciting to be a part of our military process. This was very enlightening to me as a US citizen and tax payer. Education to the population (general population) is helpful in the long run for support of projects and research. Much is publicized about research that is perceived to be wasteful and frivolous in our government. I felt true value to our country and servicemen and women during this time. My awareness increased; I hope the communication throughout the ranks happens at times also, i.e., the folks staring at the screen know they are important and research is being done to help their performance and therefore them personally as well. Thanks for the opportunity to be a part of this awesome group.”
- “Will we find out if RH gained anything valuable from this workshop?”
- “Keep up the good work. I’d like to be involved with the Idea Lab in the future as a participant and/or as a facilitator. I like the model/process, and I like being involved in the mission. Thanks for involving me.”
- “Great job! Ultimately, I appreciated the openness of the environment/atmosphere to allow for all voices to get heard and ideas to flow freely/unabashed.”
- “The facilitators were great, very knowledgeable, and able to direct the group to meet the task at hand. I love this approach, and I will use it in different areas of my life. Thank you for this opportunity.”
- “On the first day or early second day request ‘best practices’ info in writing from participants. Solicit real world examples of related application on the given topic. This might capture some good insight that might be hesitant to be verbally shared in a group. Any that might apply to the researchers’ issue can be further explored with the individual.”

POC Comments:

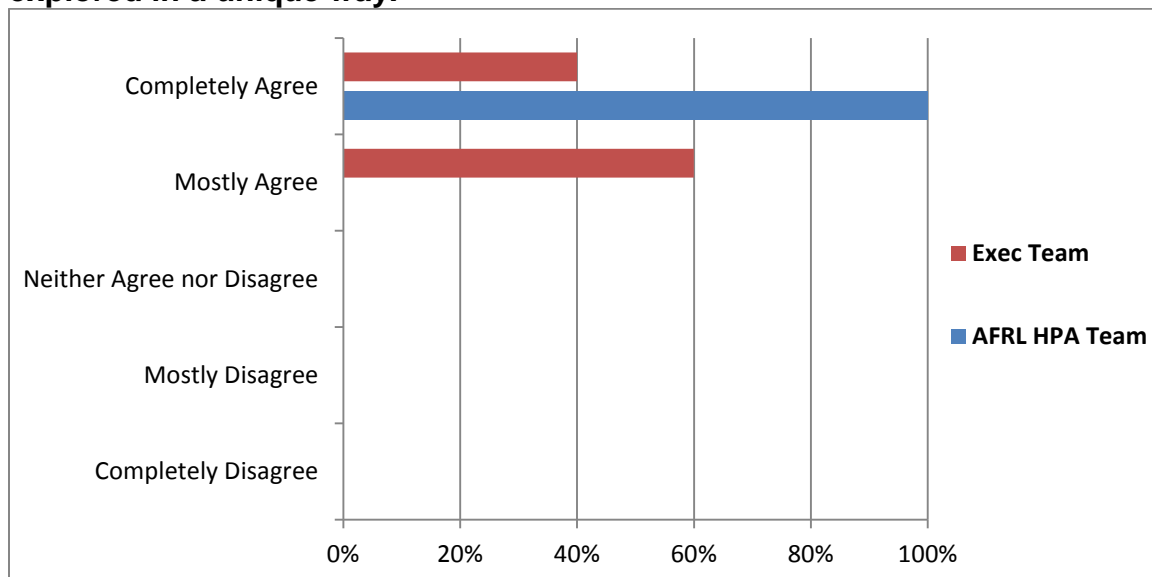
- “Great food! Team was extremely professional, friendly, and organized. They respected time and people. Nice group.”

7.10. Appendix J – Summary of HPA Product Questionnaires

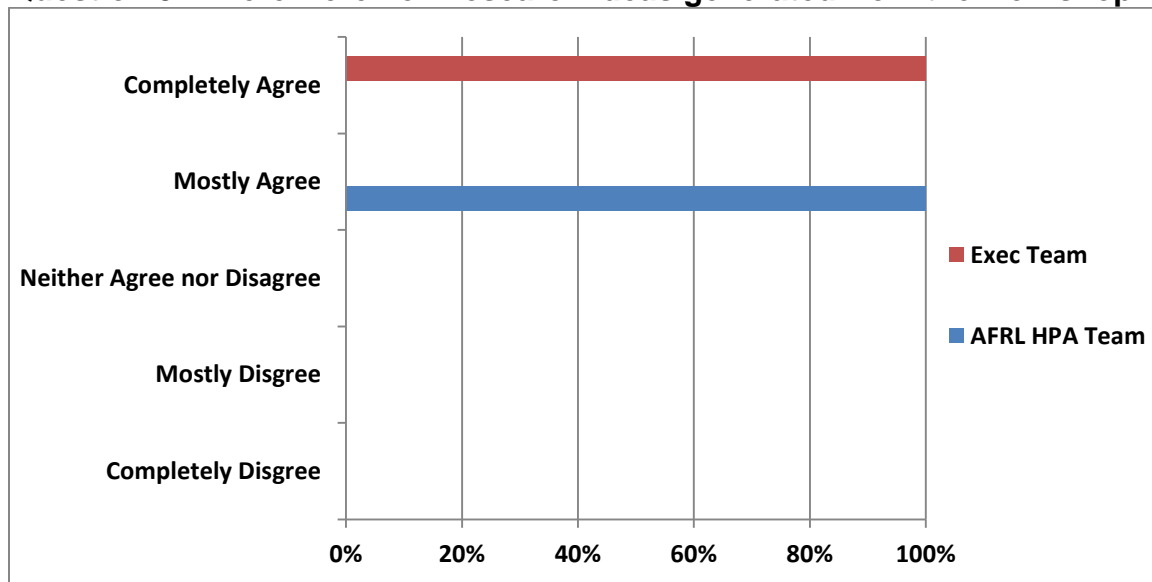
Question 1: The Workshop helped me generate new insights into the HPA challenge.



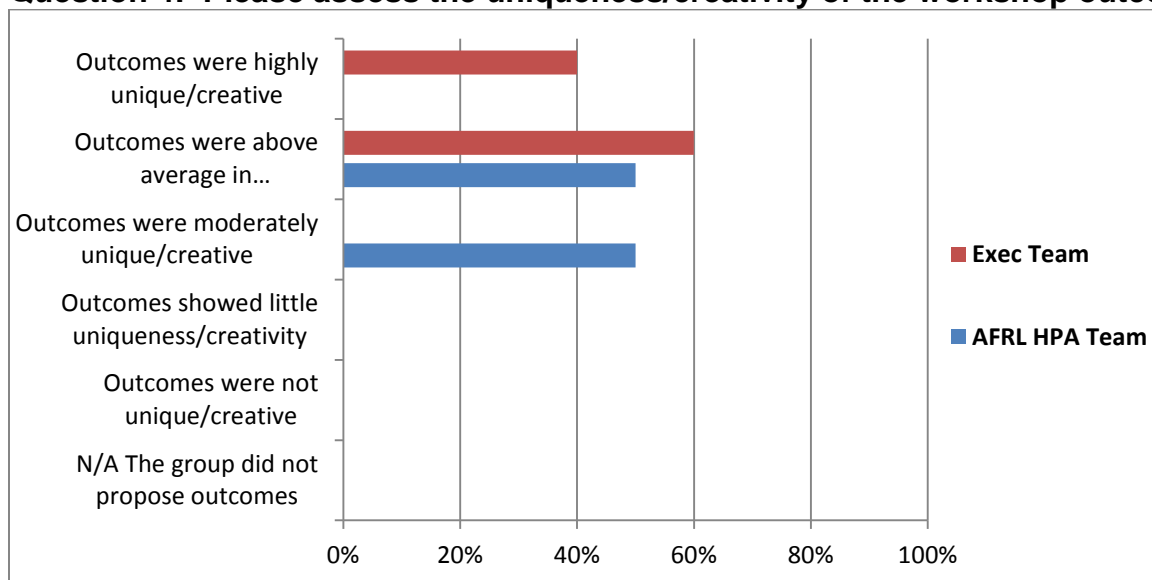
Question 2: At one or more points during the workshop, the problem space was explored in a unique way.



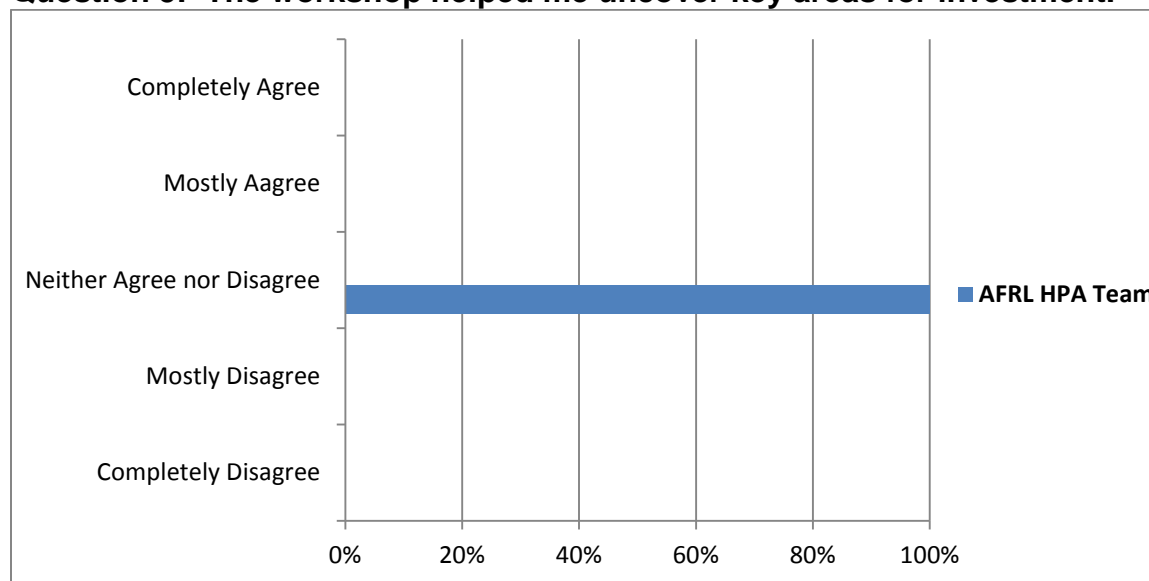
Question 3. There were new research ideas generated from the workshop.



Question 4: Please assess the uniqueness/creativity of the workshop outcomes.



Question 5: The workshop helped me uncover key areas for investment.

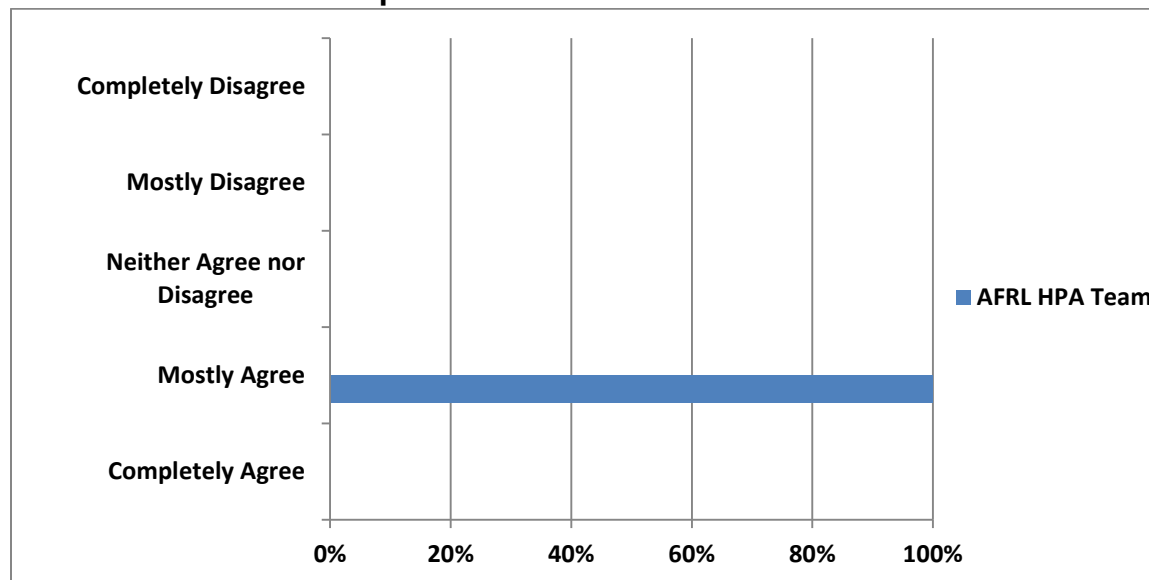


Note: Only the AFRL HPA Team filled out this question because it was non-applicable to the Executive Team.

Comments:

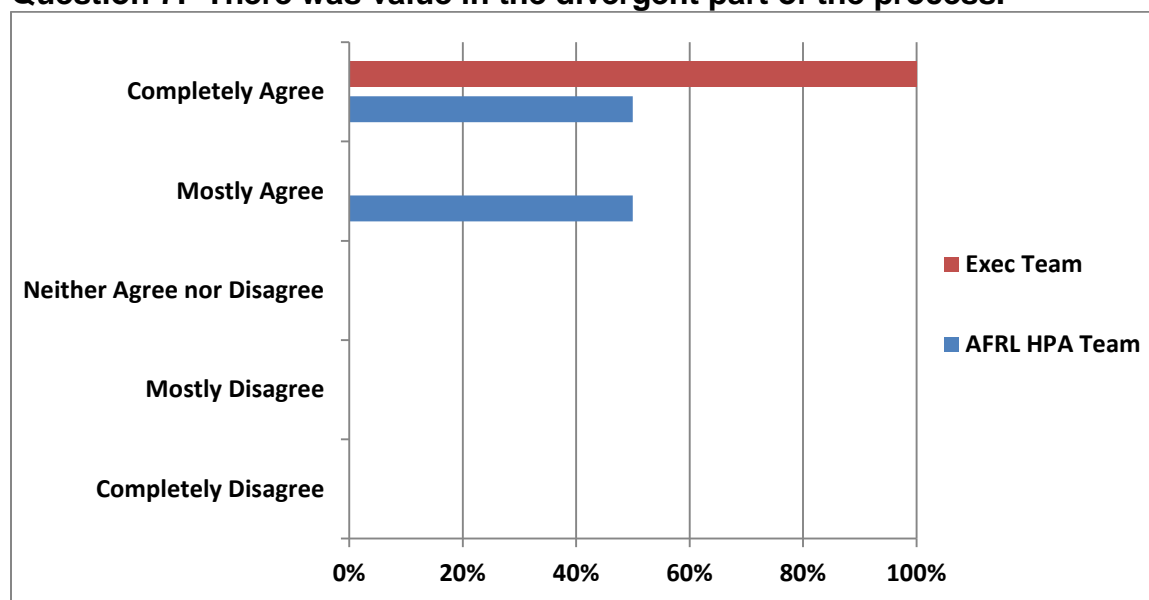
- "Not sure yet-- certainly many things to think about"

Question 6: I could have achieved the same or similar results without the Divergent CollaborationSM Workshop.



Note: Only the AFRL HPA Team filled out this question because it was non-applicable to the Executive Team.

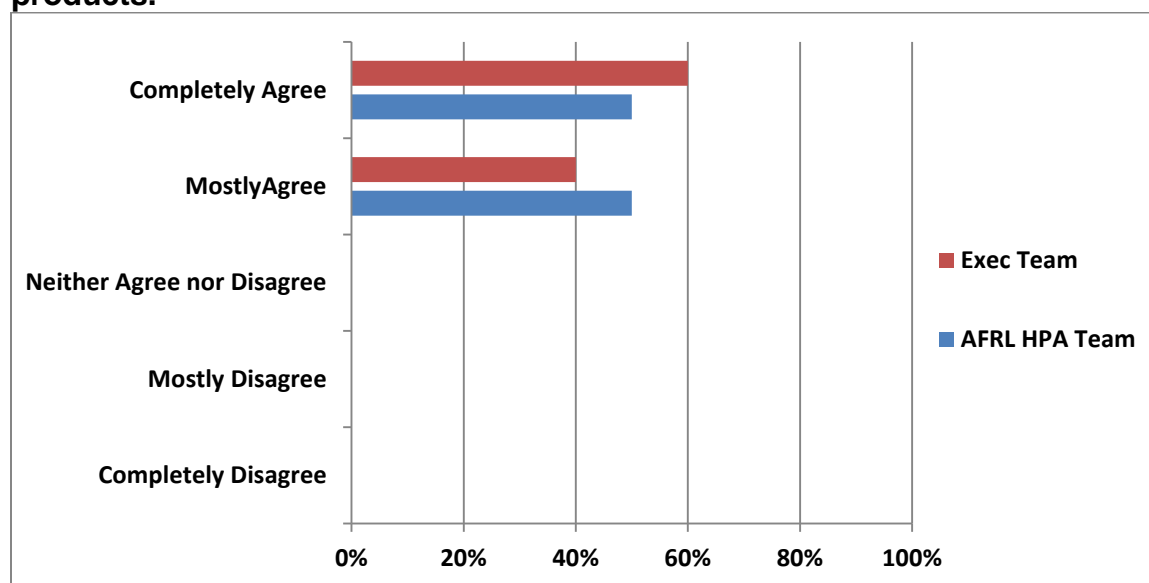
Question 7: There was value in the divergent part of the process.



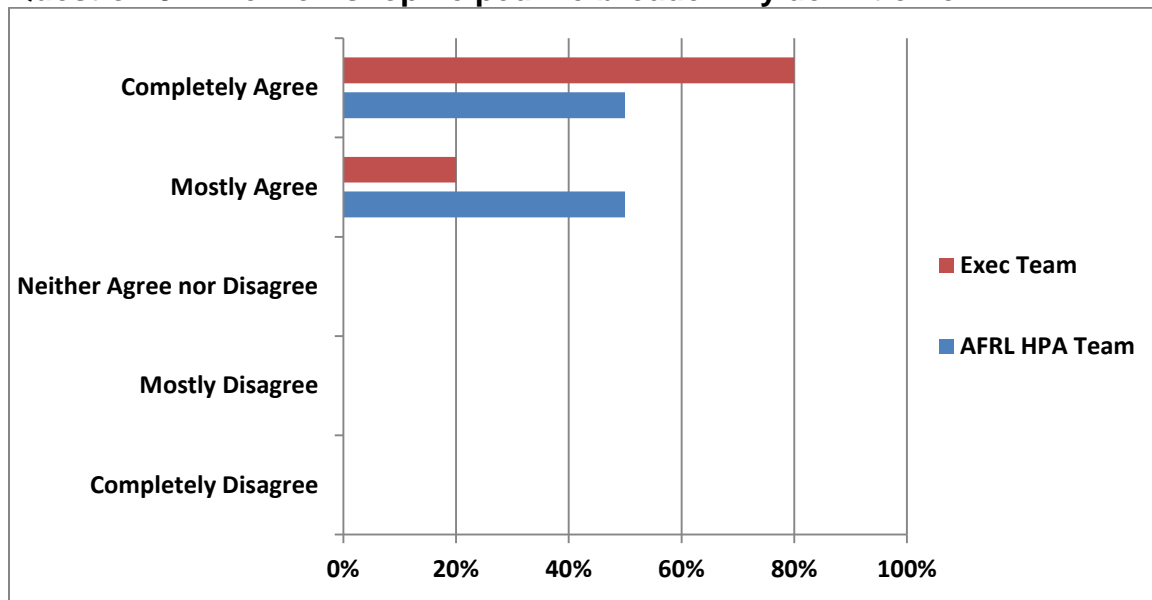
Comments from HPA Team:

- "Mostly agree, but on a personal level, completely agree"

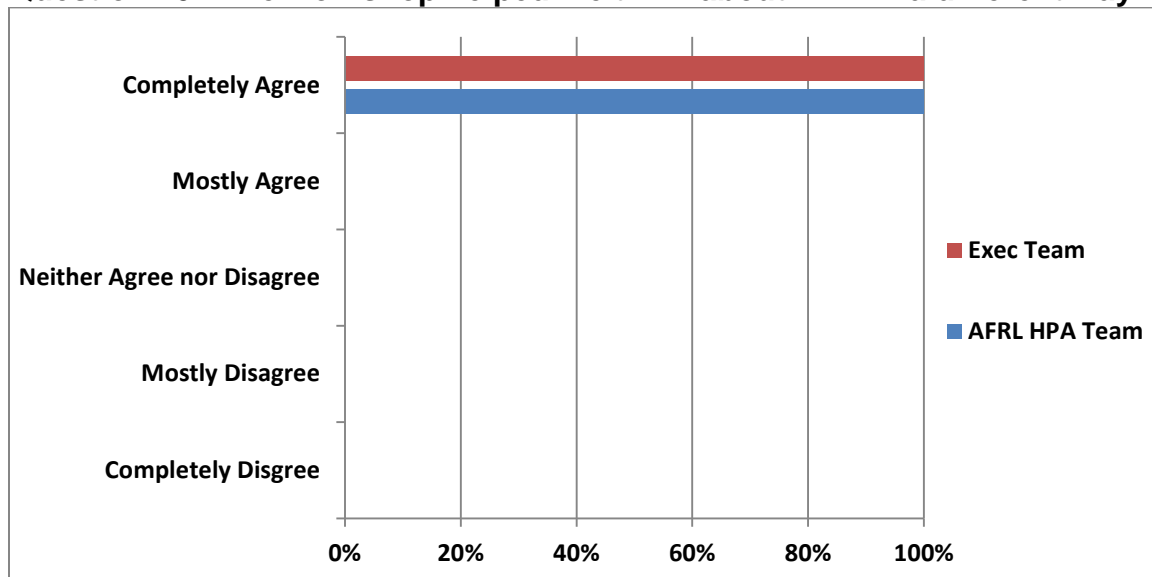
Question 8: The divergent part of the workshop impacted the innovativeness of the products.



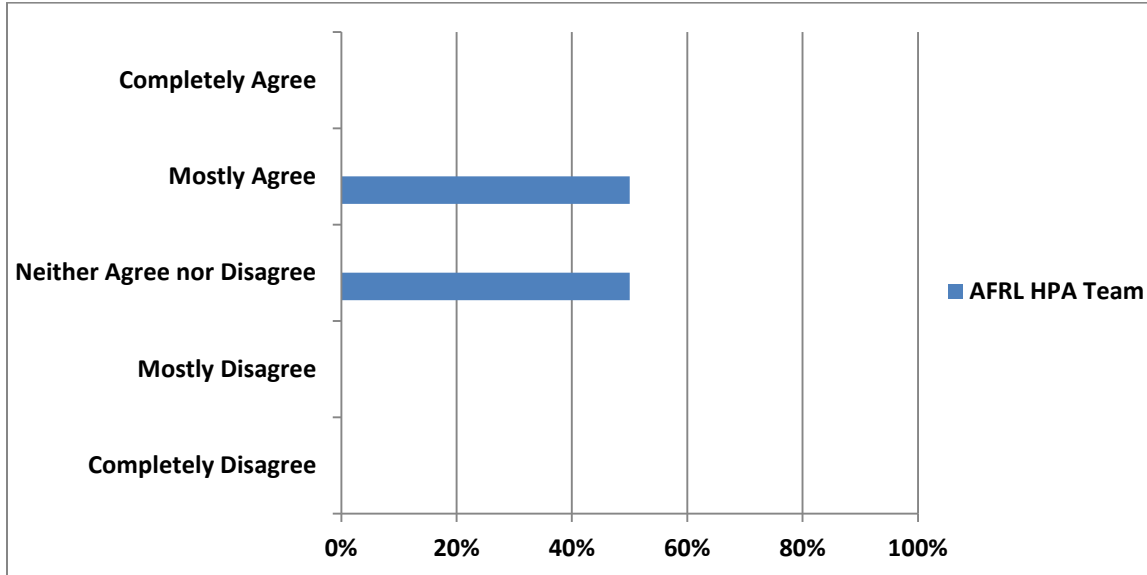
Question 9: The workshop helped me broaden my definition of HPA.



Question 10: The workshop helped me think about HPA in a different way.



Question 11: The workshop results will impact my future or existing research activities.

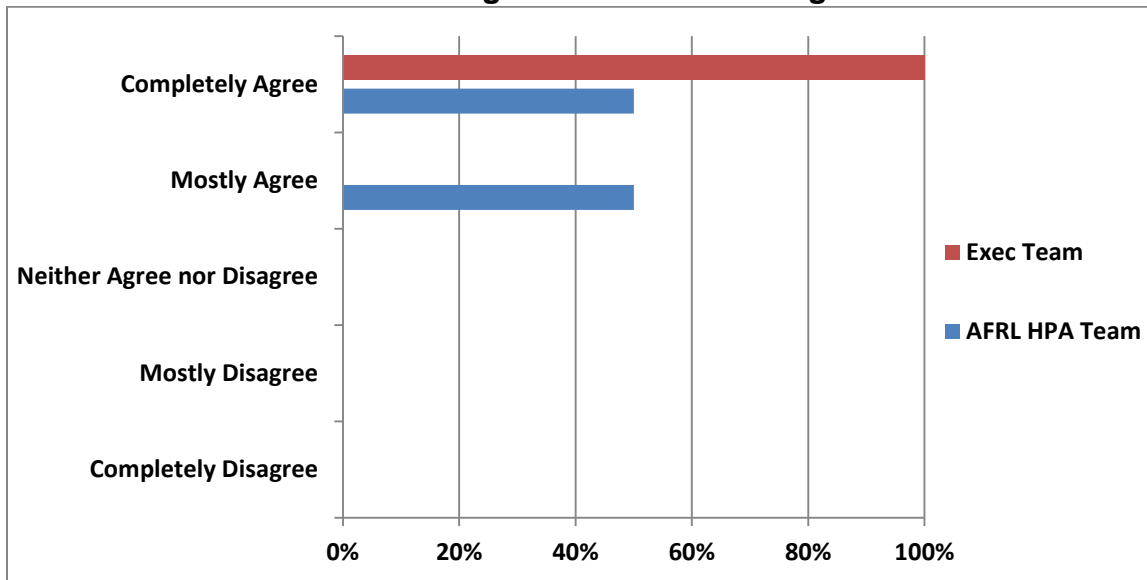


Note: Only the AFRL HPA Team filled out this question because it was non-applicable to the Executive Team.

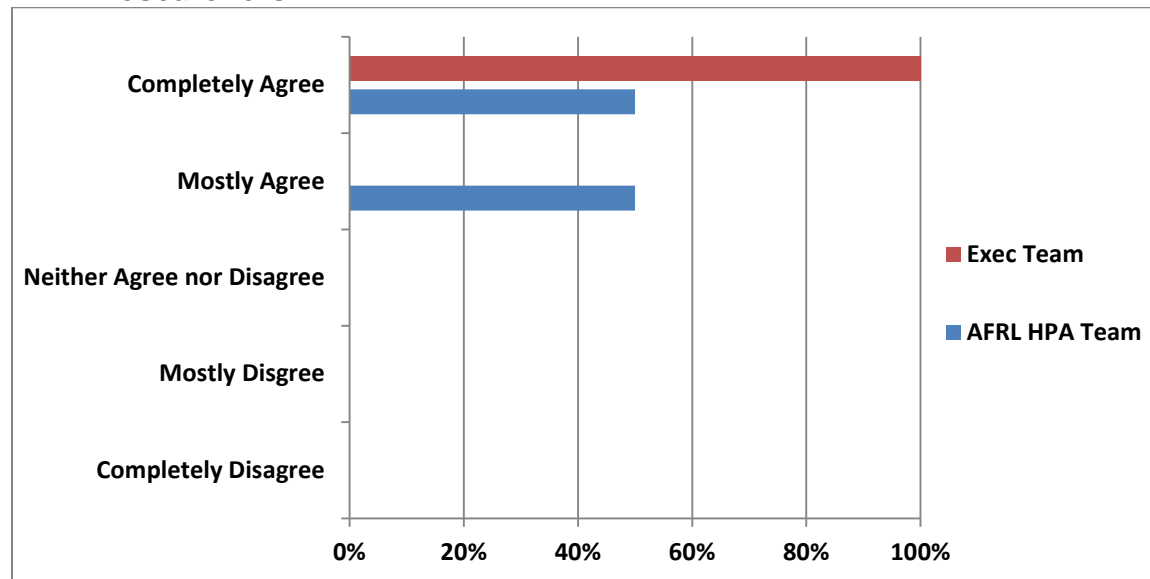
Comments:

- "Not sure yet"

Question 12: I would use Divergent CollaborationSM again.



Question 13: I would recommend a Divergent CollaborationSM workshop to other AFRL researchers.



Question 14: What was your overall impression of the Divergent CollaborationSM Workshop?

Comments from Exec Team:

- "I thought the workshop was significantly improved from the first one on Resiliency. The group was diverse in the right amount (if that makes sense), and the group cohesion was strong, nearly from the very beginning. Very happy with it! Loved having the POC support we did (Luginbuhl) and thought Nancy and Josh's participation was also the right amount. Much better ending/wrap-up and better results!"
- "The workshop was a delight to participate in-- it had a lot of positive energy surrounding it and that showed in the final product(s)"
- "The workshop was much more successful than Resiliency; more group cohesion/smoothier 'plan'/better idea generation"
- "The workshop was full of ideas and discussion. I thought that there was a good information exchange between AFRL and the participants. People were making natural connections while enhancing creativity"
- "Terrific! Best yet."

Comments from HPA Team:

- "I liked the process. It was good to hear other peoples' perspectives maybe simpler solutions (non-tech) to linking to operational/performance improvement. I liked the discussion group, team motivations, intrinsic, extrinsic motivations"
- "Very interesting way of generating new ideas and assess current ideas. Way outside of my comfort zone but was extremely helpful"

Question 15: What changes could we make to improve future workshops?

Comments from Exec Team:

- "I think we could do a better job in the converge section and application to the real problem. I think we were significantly better in this area than in Resiliency, but still think it could be improved. For example: more succinct, total picture of the problem (we were too focused on the "30 min analyst") and being able to facilitate the group seeing the bigger picture. Also thought the matrix used in the converge section wasn't ideal. We could have bucketed it into the 3 categories after the fact (way out there ideas, actionable research, products) or just used them as prompts for the participants to think about- not as a way to categorize or frame our thinking. I would have liked to see us explore: 1.) before [missions and work] 2.) during [in progress] and 3.) after [missions and work]"
- "Change it to one full day followed by 1/2 day."
- "This workshop has improved significantly since the last one; however, we need to rework the overall structure. We need to decrease the amount of "diverge" time and increase the "converging." While Bart and Kathy were successful in "wrapping-up" the workshop, I don't think the participants were ready/they still had more ideas coming. We need to plan this part out better."
- "Hard to come up with many changes. I would continue to keep the group in metaphoric thinking as long as possible. Overall, I thought the workshop was great."
- "Take it even further with the lessons learned. But the design for the HPA is definitely the starting point for the Autonomy DC."

Comments from HPA Team:

- "Reel the discussion in when it gets to problem solving; small groups for convergence and ideas of technology; more wild ideas"
- "no improvements that I can think of..."

Question 16: Comments and/or Suggestions?

Comments from Exec Team:

- "Much better than Resiliency Workshop. Was it the participants? The order of events? The topic? Not sure."

Comments from HPA Team:

- "Great group; Great Divergent CollaborationSM organization team; very professional/out-going/open. Great food."

7.11. Appendix K – Demographic Information for Autonomy Participants

Gender

- | | | |
|----------|----|-------|
| • Female | 5 | (33%) |
| • Male | 10 | (67%) |

Age:

- | | | |
|-----------|---|-------|
| • 20-29 | 3 | (20%) |
| • 30-39 | 1 | (7%) |
| • 40-49 | 6 | (40%) |
| • 50-59 | 1 | (7%) |
| • Over 60 | 4 | (26%) |

Education:

- | | | |
|------------------------|---|-------|
| • Post Master's Degree | 7 | (47%) |
| • Master's Degree | 2 | (13%) |
| • Undergraduate Degree | 6 | (40%) |
| • High School Diploma | 0 | (0%) |

7.12. Appendix L – Comprehensive List of Ideas from the Autonomy Group

HUMAN

- Culture/simplicity/trust – find the common ground
- Marketing good things about UAVs; educate the public
- Generational considerations – understand their core values, attitudes, way they work, how they view autonomy
 - Boomers (ages 48-65)
 - Gen X (ages 31-47)
 - Millennial (ages 18-30)
 - TRUST – who's not trusting? The RPA operators (younger people) trust what they are doing; the ones at the top making the decisions (older people) generally don't
- Reverse mentoring: have younger generations teach/train/mentor older generation on technology
- Comfort with the machine → creates trust
 - Consistent interaction
 - Training
 - Experience
 - Education
 - Simulation
 - Mentoring
- Recognize there will be fear of adoption that will need to be worked through

MACHINE

- Look at simple solutions – reduce complexity, simplify the machine
- Kiss, think Basic
- Understand the culture of desired autonomy
- Start new – blank page
- Make it to fulfill operator's requirements, not what AFRL wants it to be
- Don't approach RPAs in the same way as a traditional aircraft, approach it differently
 - Change roles – enlisted person by flyer
 - Different ways to use manning- not traditional way of using aircraft. Make autonomy/automation capabilities on what people using it *actually* need. Focus on requirement needs for RPA operators
- Approach from human perspective

- Simplify user interface
- Get people to realize systems are safe

TEAMING

- Best practices from the highest performing teams
- Continued virtual collaboration on the problem with Divergent CollaborationSM group
- Work directly with RPA Operator and analyst to explore problem (or mission architects) – get their perspective to solve problems; functional decomposition
- The Four Levels of Collaboration – determine what type of teaming/level of collaboration is appropriate for each human-machine team or each autonomous system
 - Communicate
 - Coordinate
 - Cooperate
 - Collaborate
- Mentoring process needed for new members; supervision, feedback
 - Like Blue Angels or Thunderbirds
 - Bring in the best people and give them the best training
- Standardization can be used for creating teams, e.g. National Aerospace System
 - For consistency, for training
- Train on how to be a team – how do you interact with each other?
- Is there shared understanding between AFRL TDs (siloed)?

IN

- Focus on mid-term issues, not just now and 25 years in the future

AUTONOMOUS

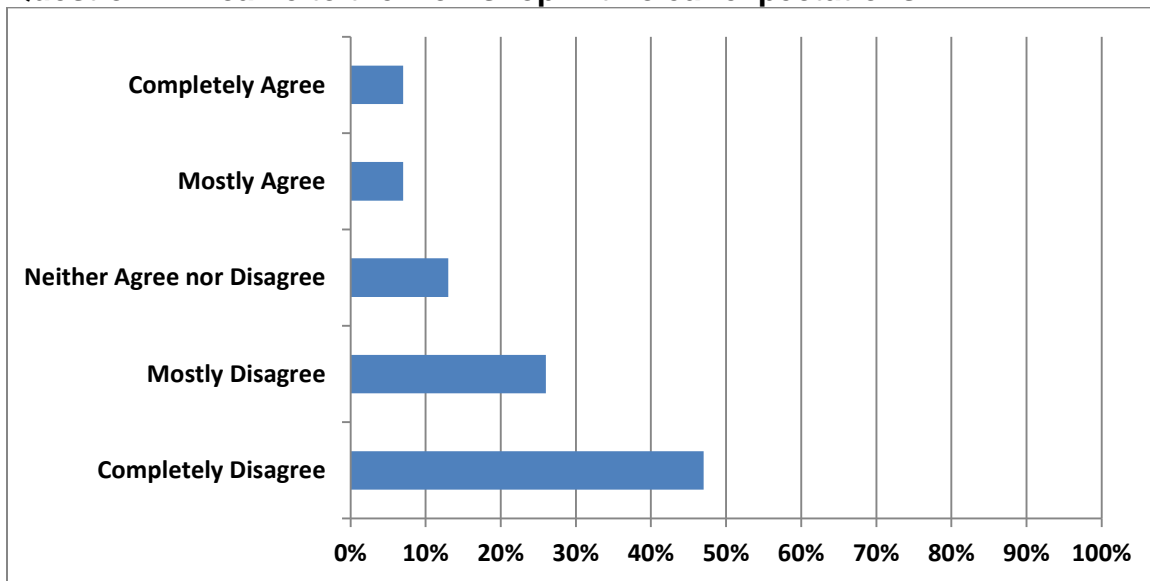
- Balancing risk of autonomy, perception, and politics
- What's left over after autonomy – for the person to exercise good judgment. This is a whole new and different way of thinking about the problem
 - What level of proxy/authority to give the automation?
- Human intervention is key – is the solution and the problem:
 - How to ensure human can't turn off automation/autonomy if they don't accept it so the machine can do what it is supposed to do vs. when machines fail, humans pick up the slack - leaving things to machine goes wrong more often if the human isn't there to intervene

SYSTEMS

- Just-in-time best practices
- More efficient process
- Look at biological systems for sensing/means of communication
- Use current systems that use human and study what it would be like without human (use gaming and simulations)
- Use best practice systems that exist to design the right system (capitalize on lessons learned)
- Safety systems – market it
- “Should we be doing this?” – employ process engineer to look at the actual process. What can we avoid doing?
- AF operates in silos; TDs don’t work together – not systems engineering approach (AF culture)

7.13. Appendix M – Summary of Autonomy Process Questionnaires

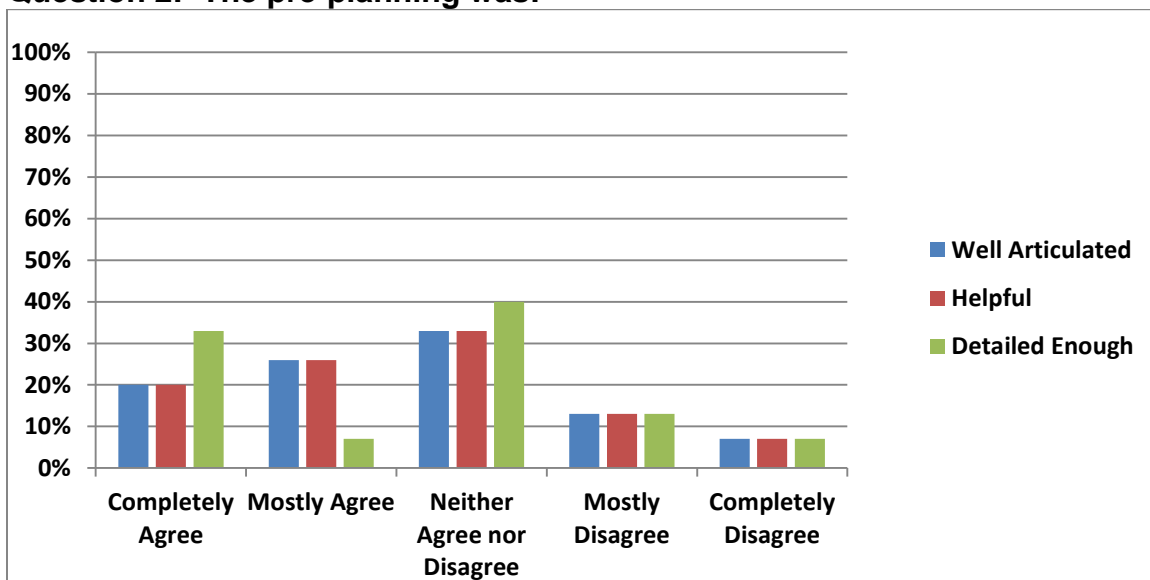
Question 1: I came to the workshop with clear expectations.



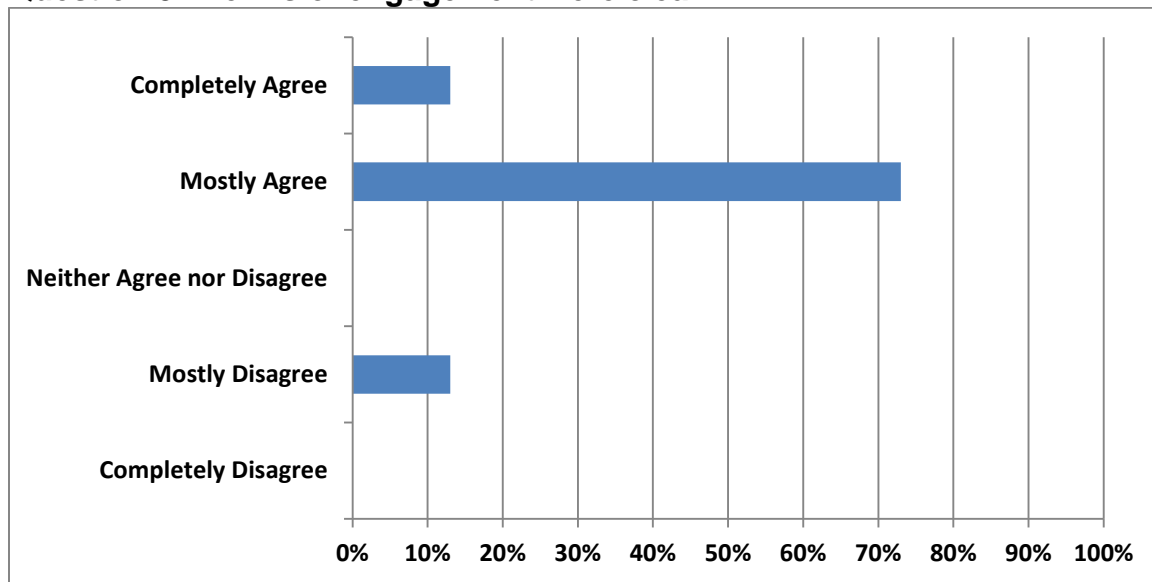
Comments from participants:

- "Mostly disagree, but that's OK!"
- "I think not knowing was on purpose."
- "It was clear you weren't telling us."

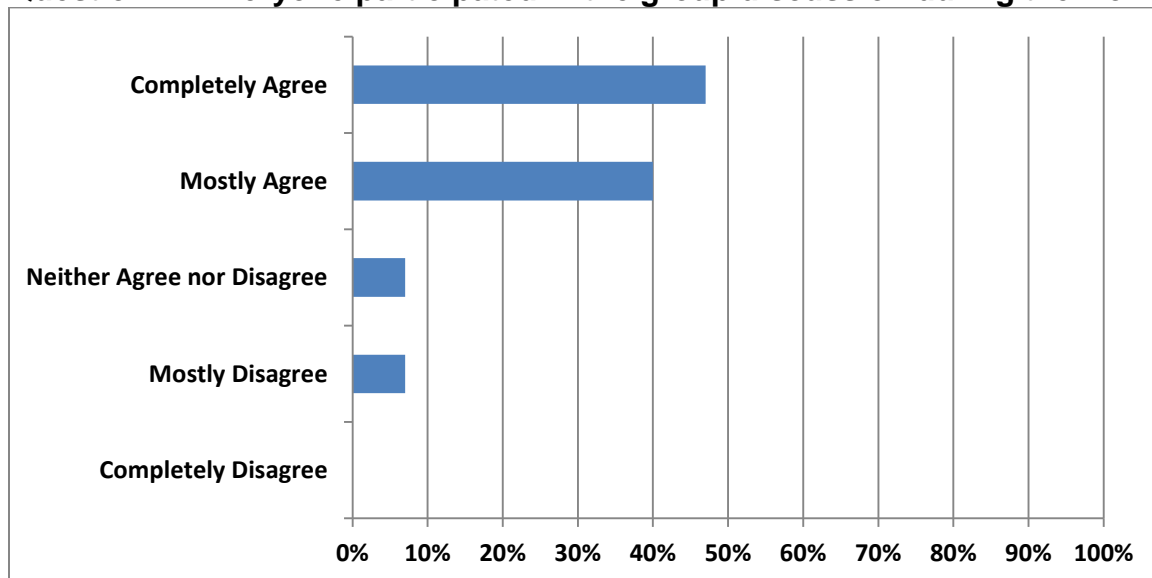
Question 2: The pre-planning was:



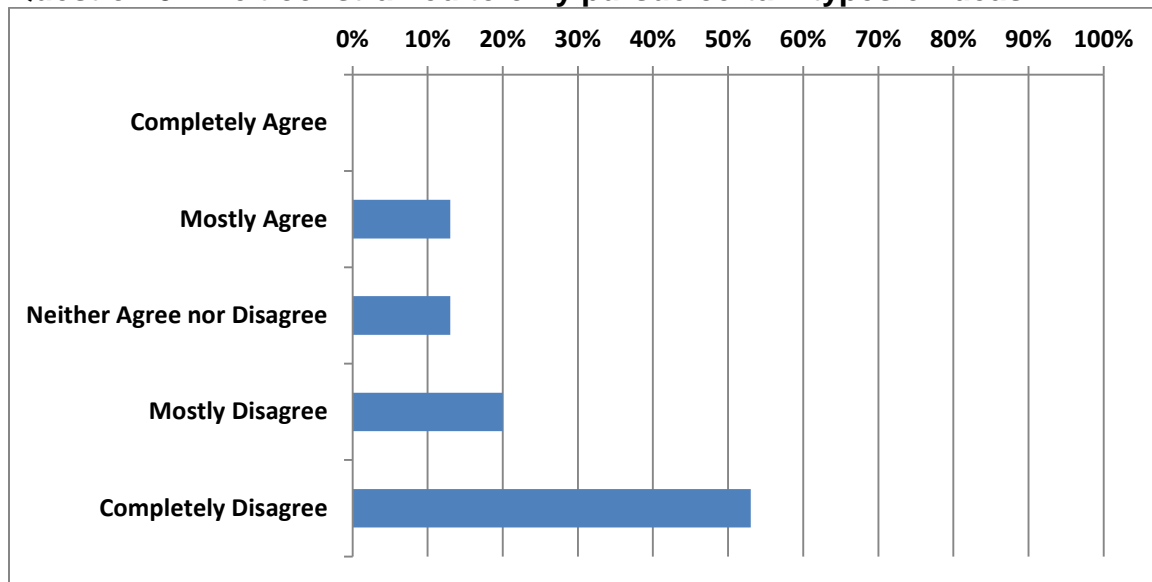
Question 3: Terms of engagement were clear.



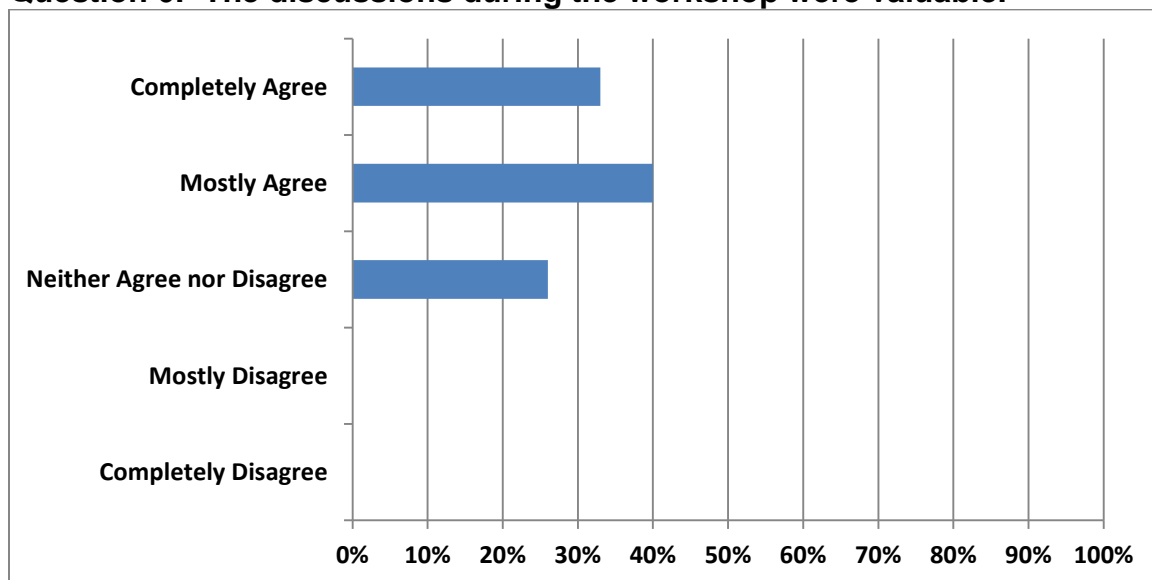
Question 4: Everyone participated in the group discussion during the workshop.



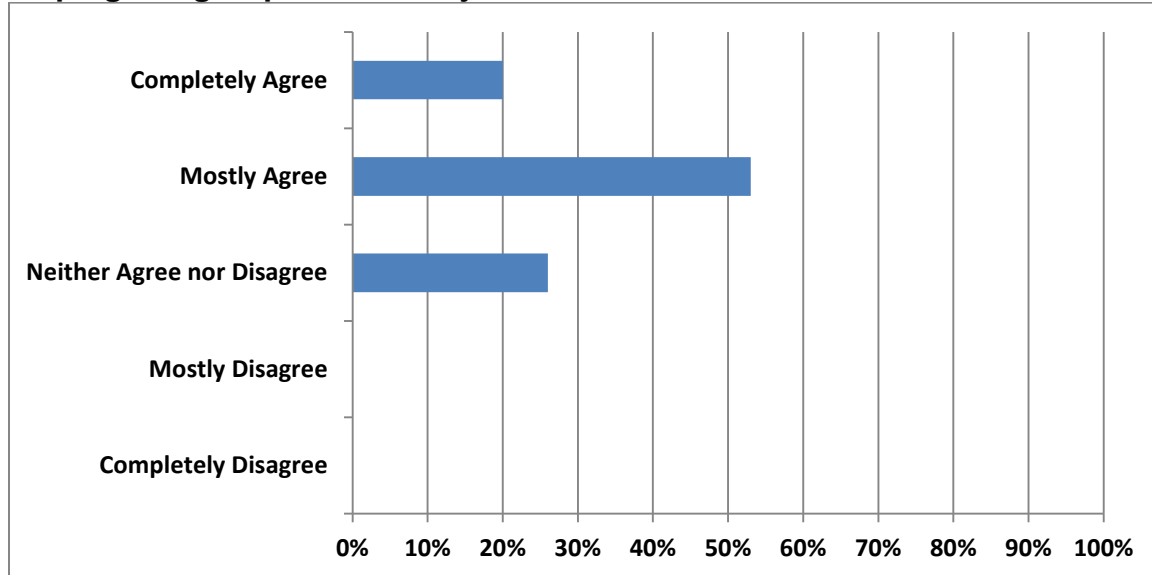
Question 5: I felt constrained to only pursue certain types of ideas.



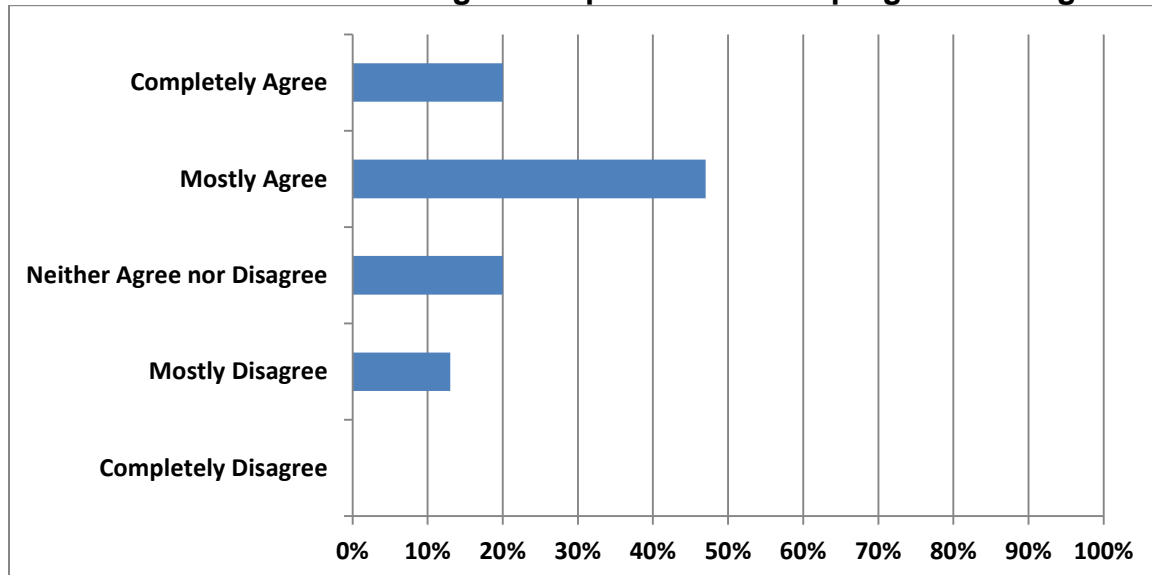
Question 6: The discussions during the workshop were valuable.



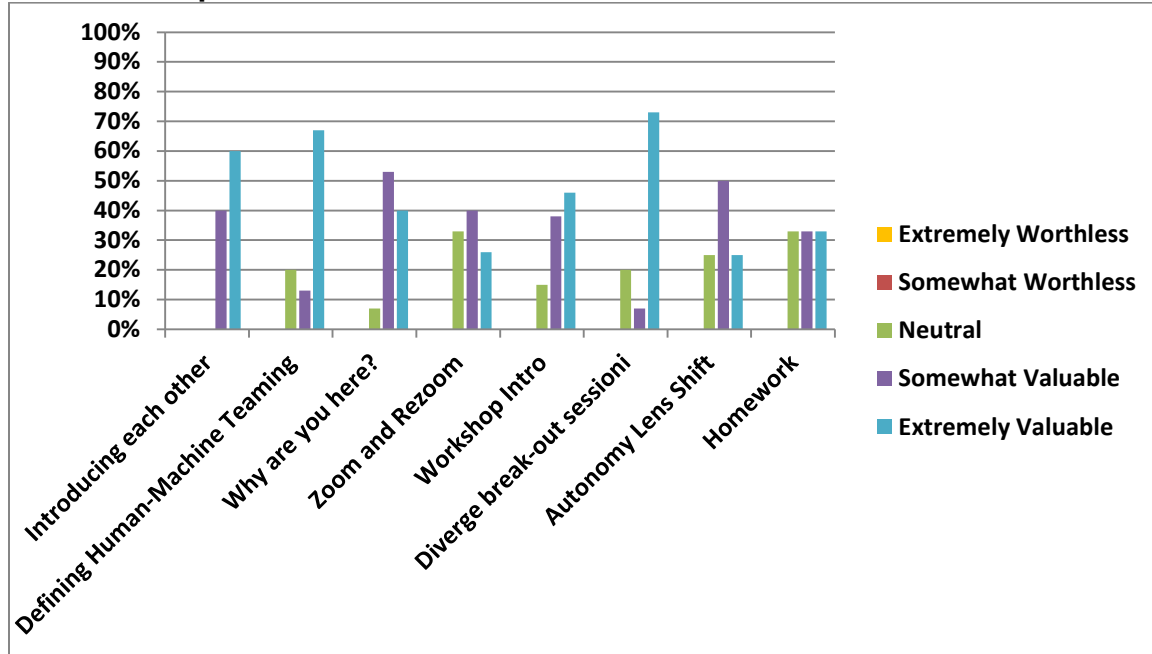
Question 7: The process and activities used in this workshop were essential in helping our group meet its objective.



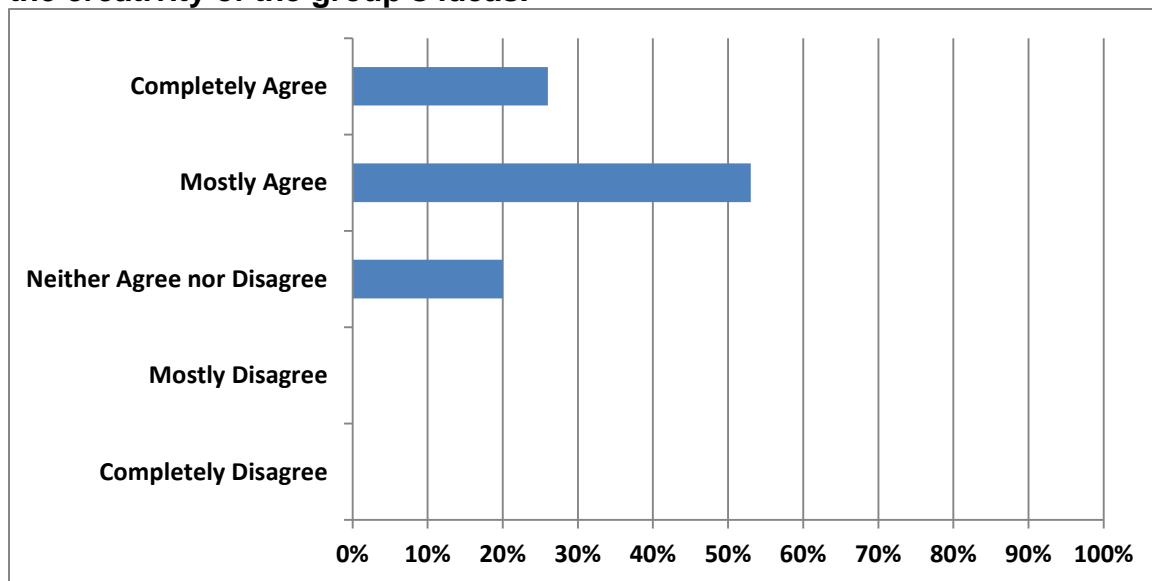
Question 8: The Process Diagram helped me to track progress during the workshop.



Question 9: Rate the activities below in terms of if you think they were valuable to the workshop.



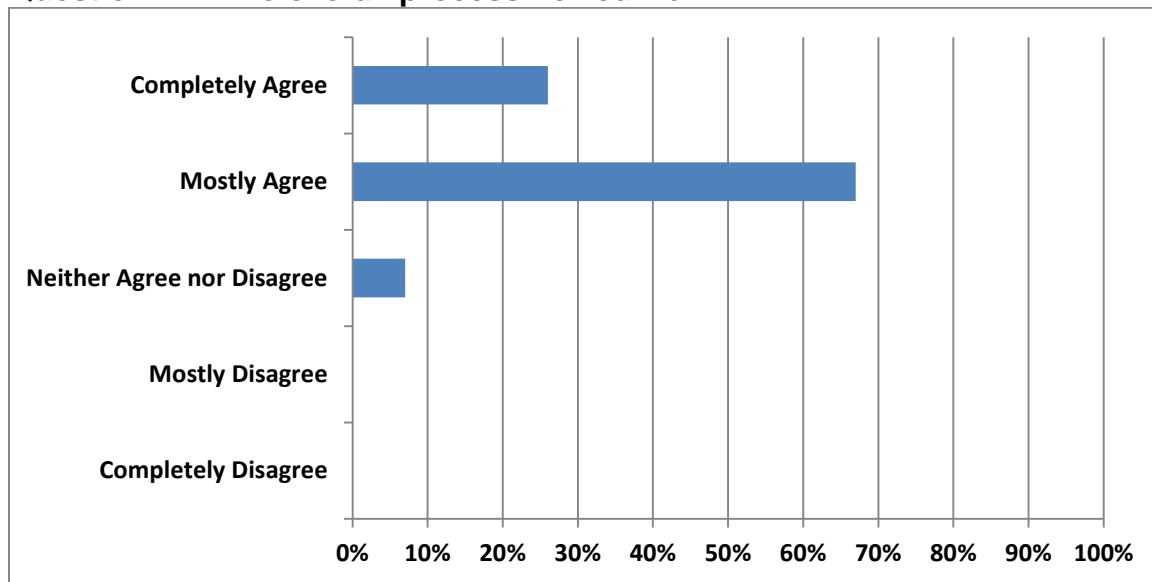
Question 10: The process and activities used in the workshop significantly enhanced the creativity of the group's ideas.



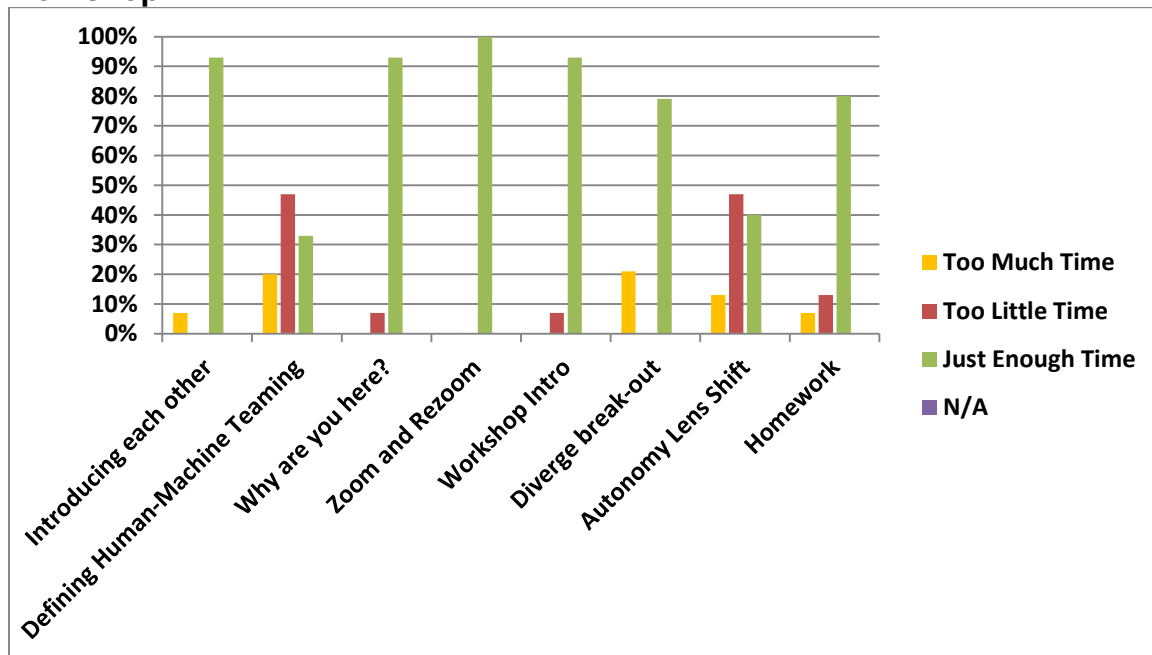
Comments from participants:

- "Homework not detailed enough"

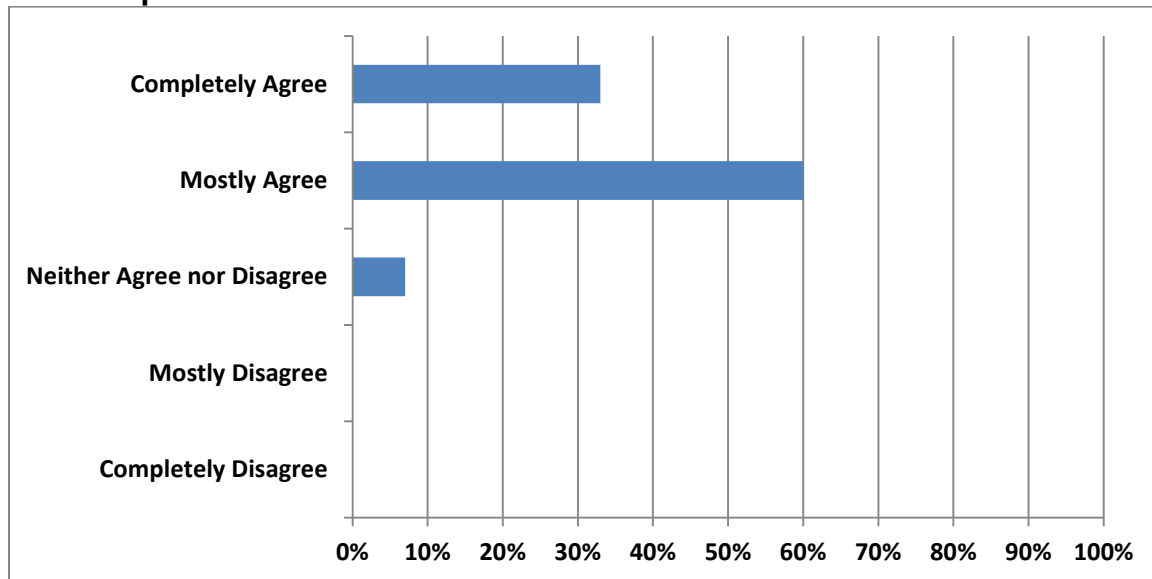
Question 11: The overall process flowed well.



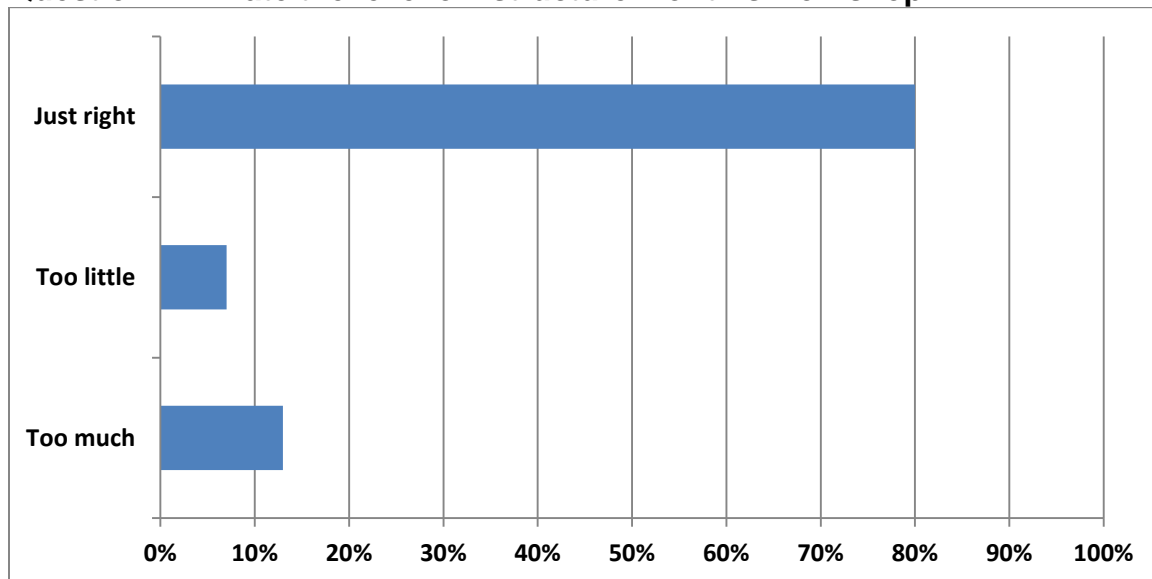
Question 12: Rate the length of time spent in each of the following areas during the workshop.



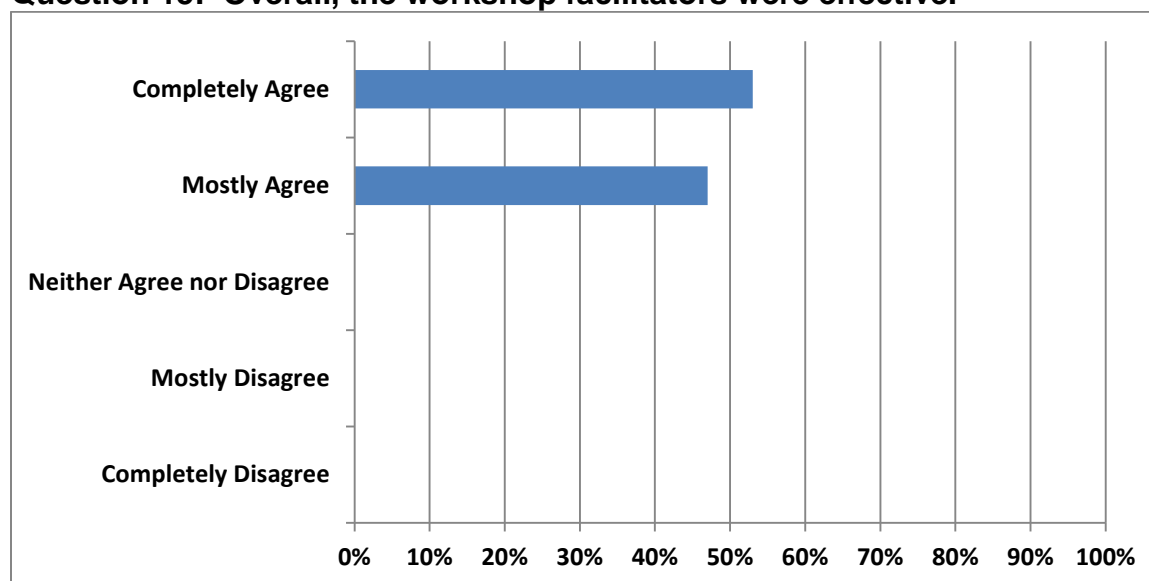
Question 13: The group took full advantage of the activities introduced during the workshop.



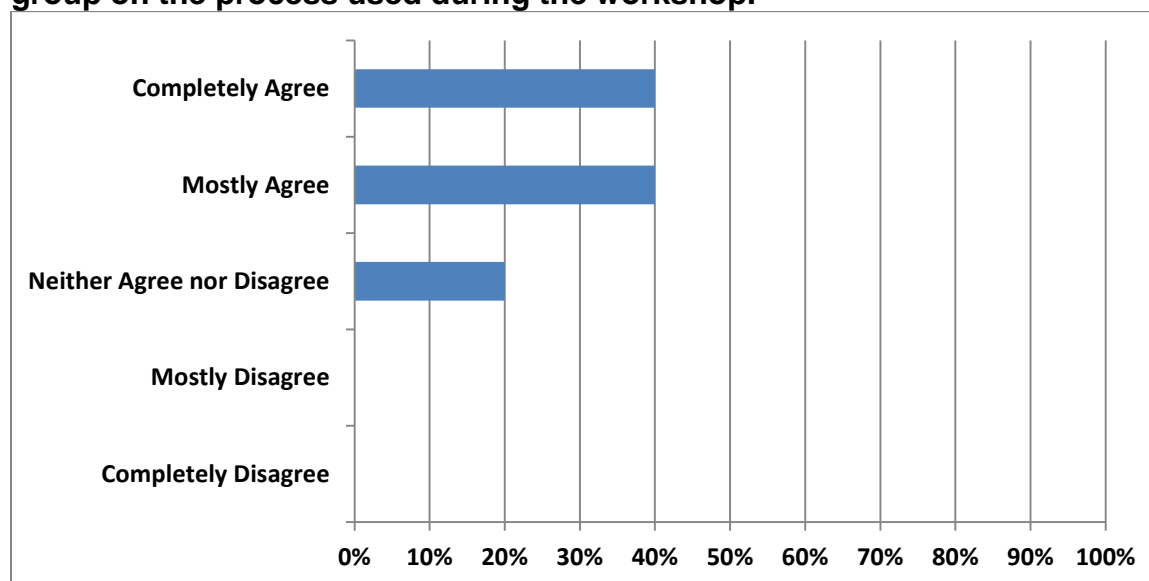
Question 14: Rate the level of “structure” for this workshop.



Question 15: Overall, the workshop facilitators were effective.



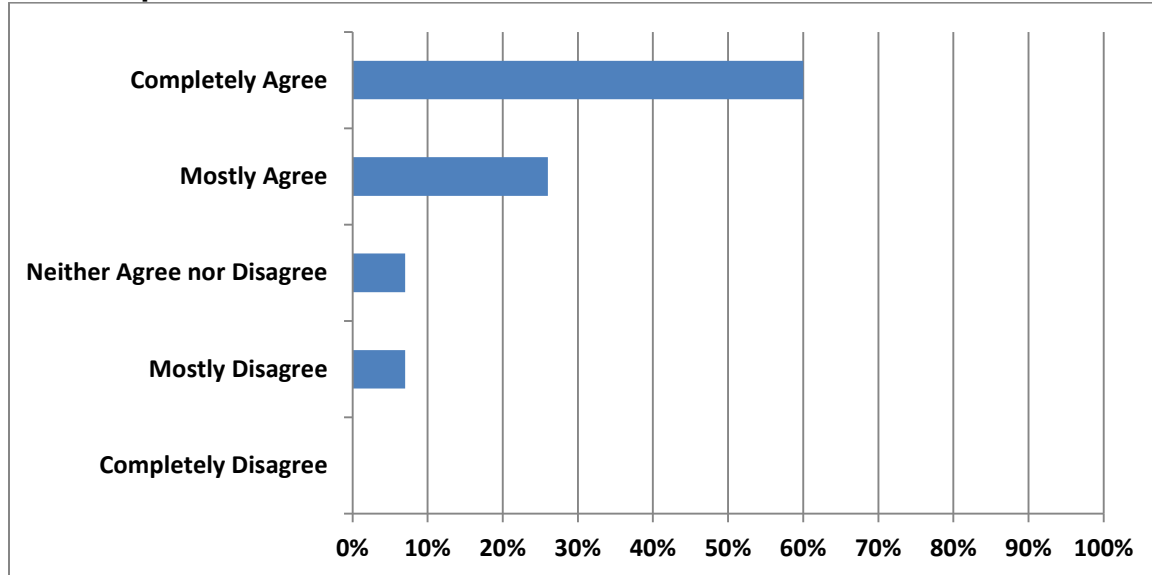
Question 16: The workshop facilitators had sufficient knowledge to instruct our group on the process used during the workshop.



Comments from participants:

- "more interaction between the main facilitators and the speakers (Kris/Bob) would have been beneficial in this session"

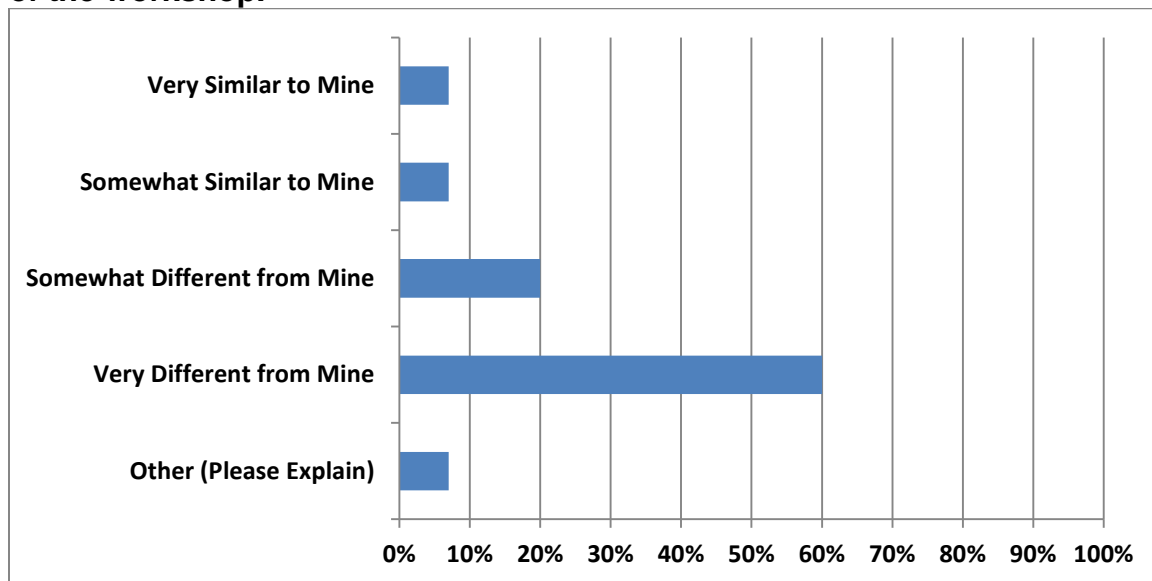
Question 17: The workshop facilitators answered questions effectively during the workshop.



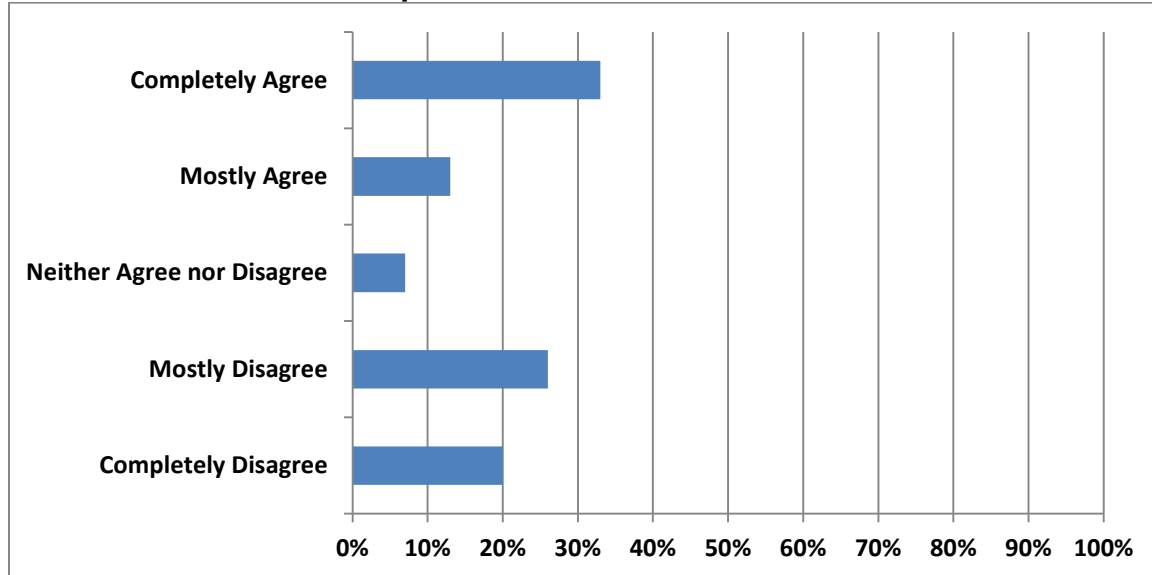
Comments from participants:

- "Each one answered but together were incoherent."

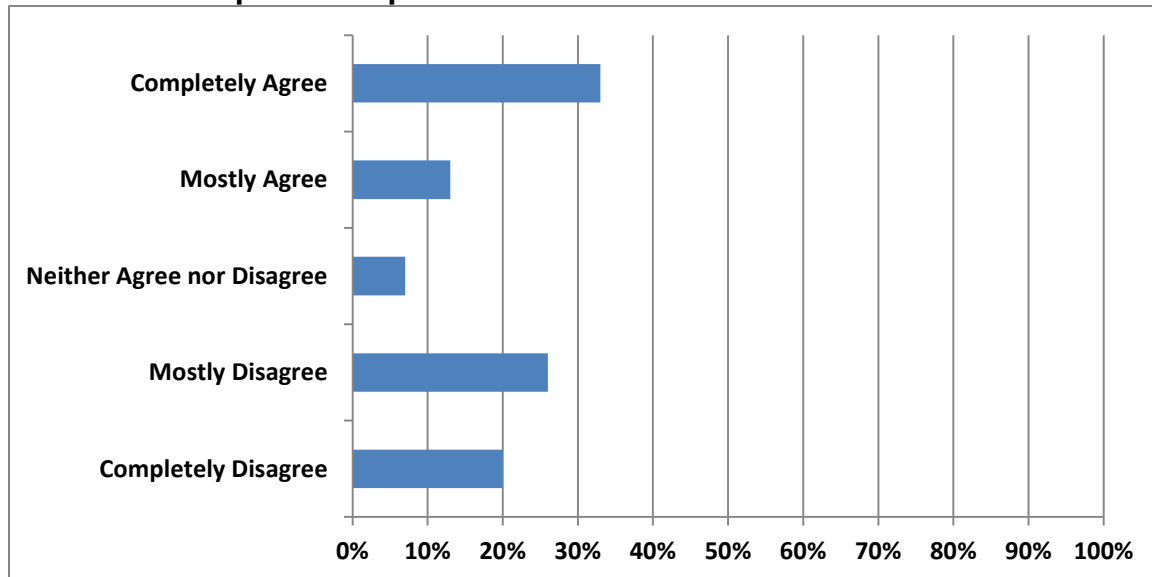
Question 18: Describe your area of specialization as compared to the other members of the workshop.



Question 19: I had a great deal of prior knowledge/expertise on the topic/problem we examined in this workshop.



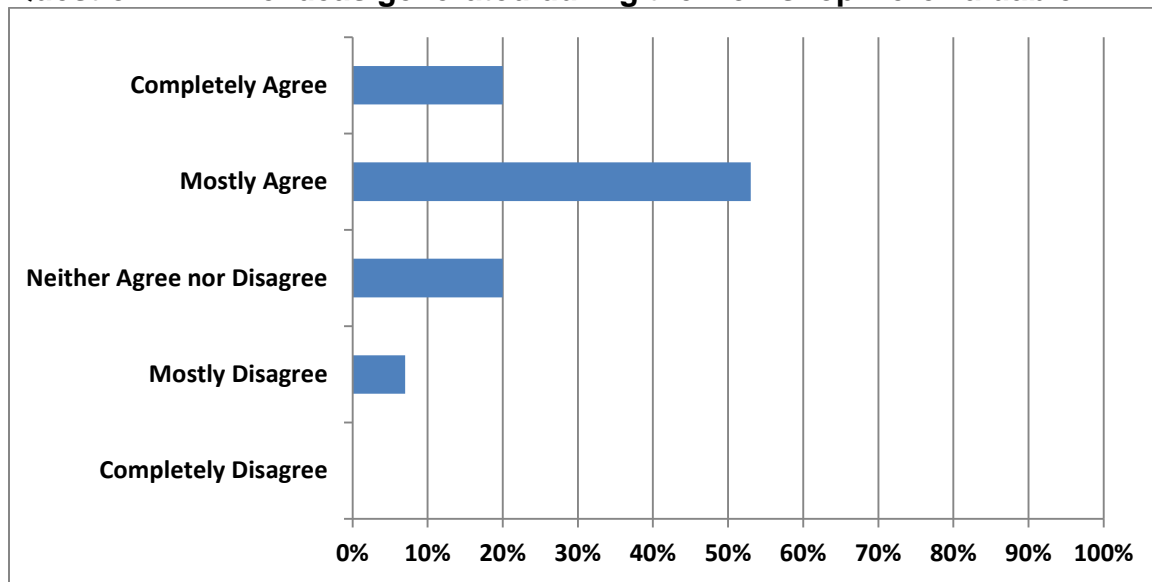
Question 20: The knowledge and experience of the workshop participants were sufficient to explore this problem.



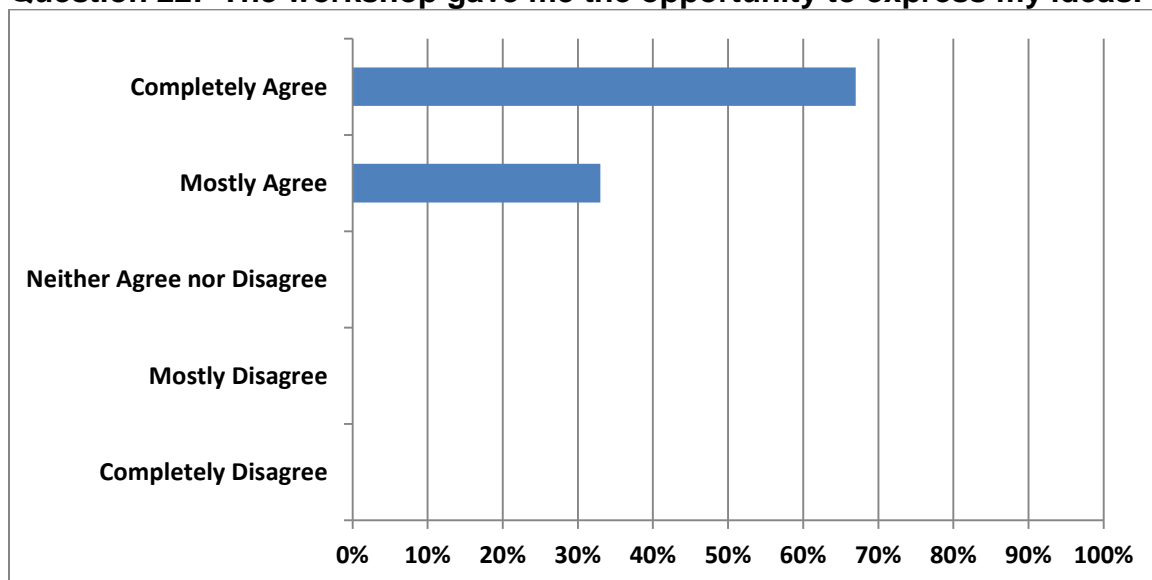
Comments from participants:

- “depends on definition of the problem”

Question 21: The ideas generated during the workshop were valuable.



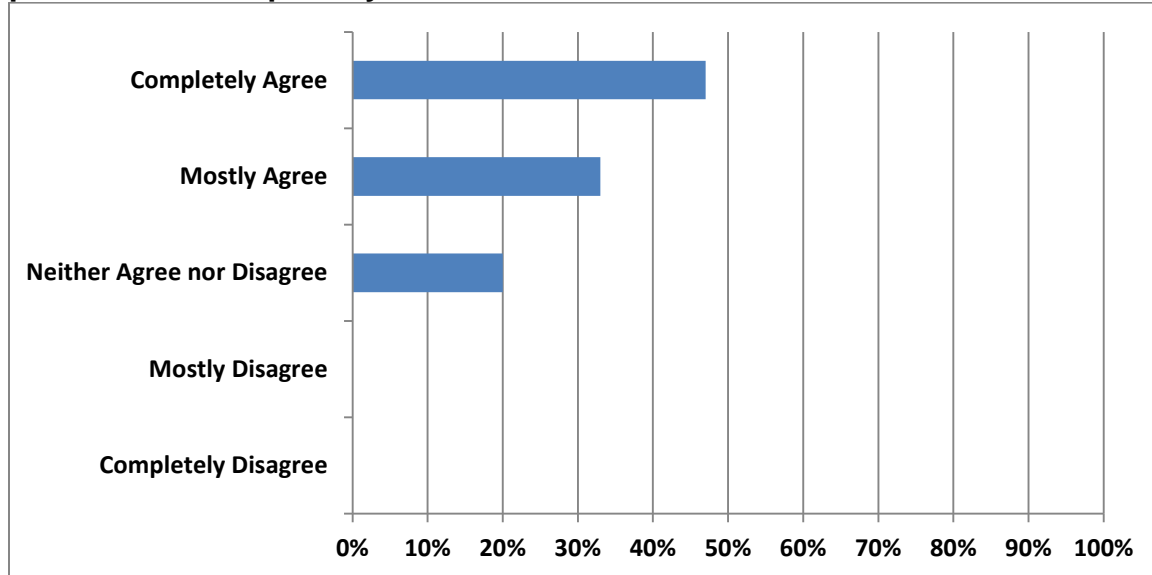
Question 22: The workshop gave me the opportunity to express my ideas.



Comments from participants:

- “except when some took over the discussion in the break-out groups”

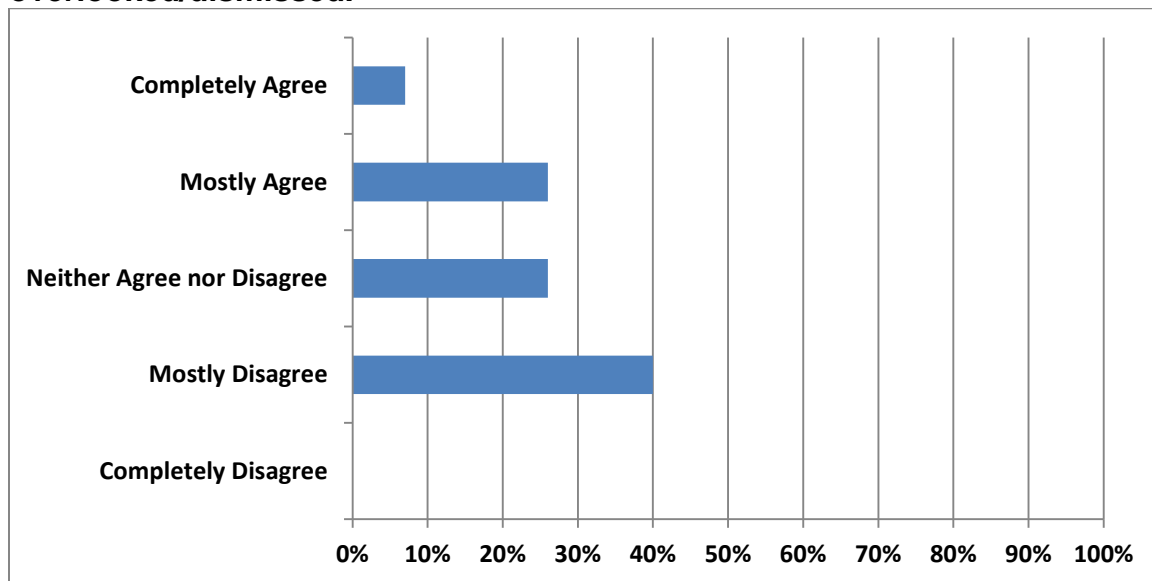
Question 23: At one or more points during the workshop, the group approached the problem in a unique way.



Comments from participants:

- "Nathan's "why" question . . . but little time spent on it."

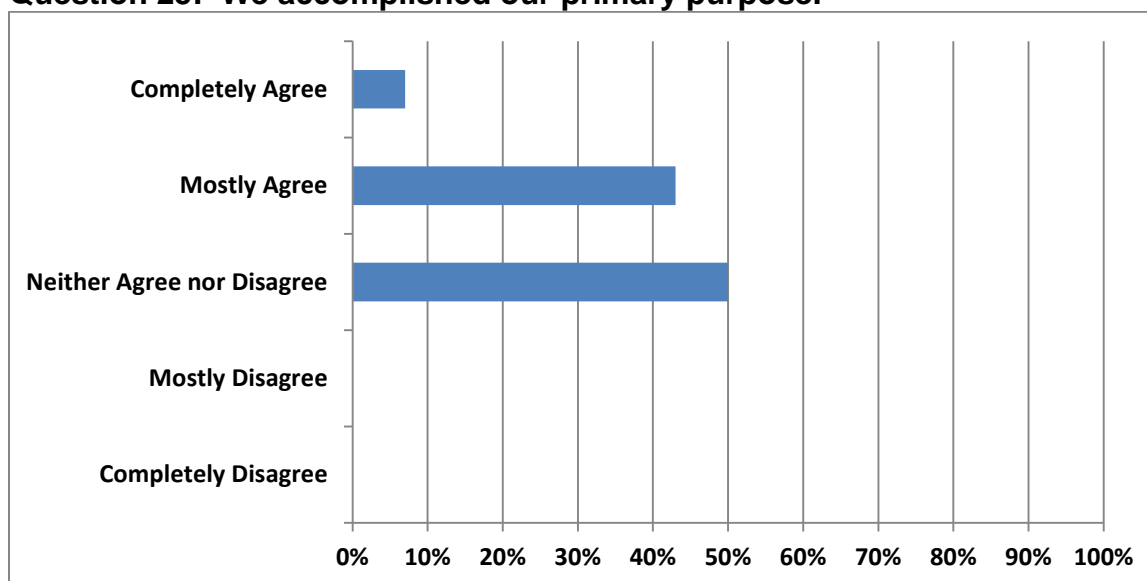
Question 24: In looking back, I believe there were ideas that our group overlooked/dismissed.



Comments from participants:

- "Nathan's "why" question . . . but little time spent on it."

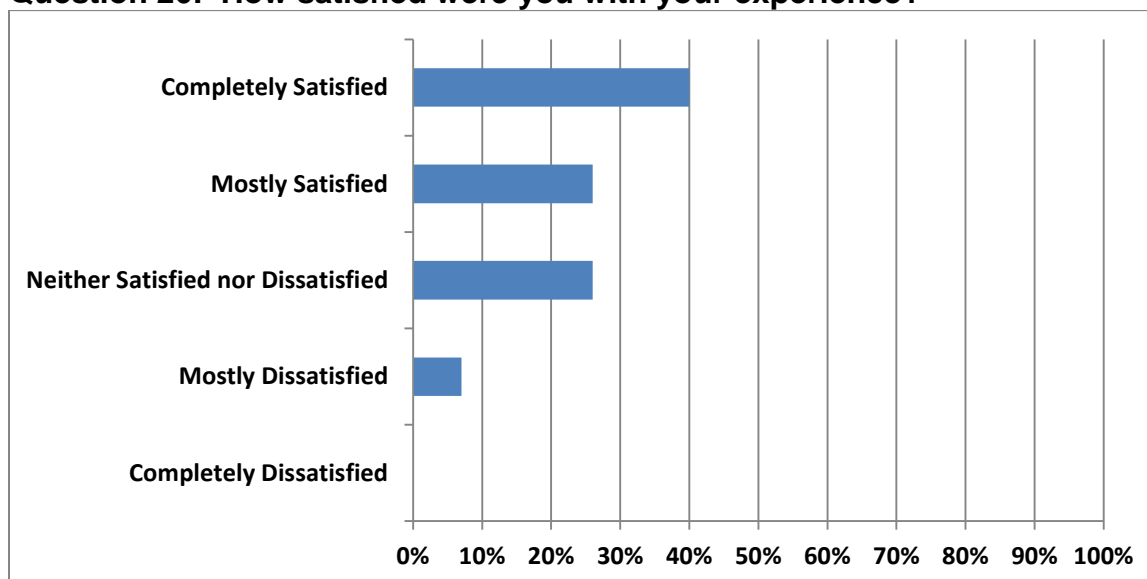
Question 25: We accomplished our primary purpose.



Comments from participants:

- “N/A, uncertain”
- “not quite sure what our primary purpose was”

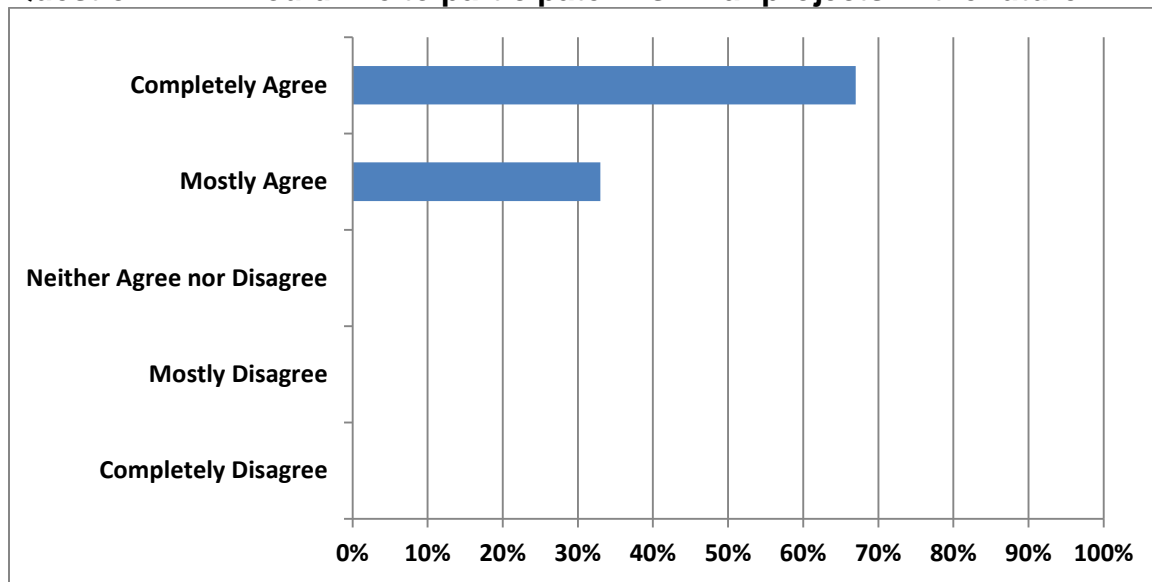
Question 26: How satisfied were you with your experience?



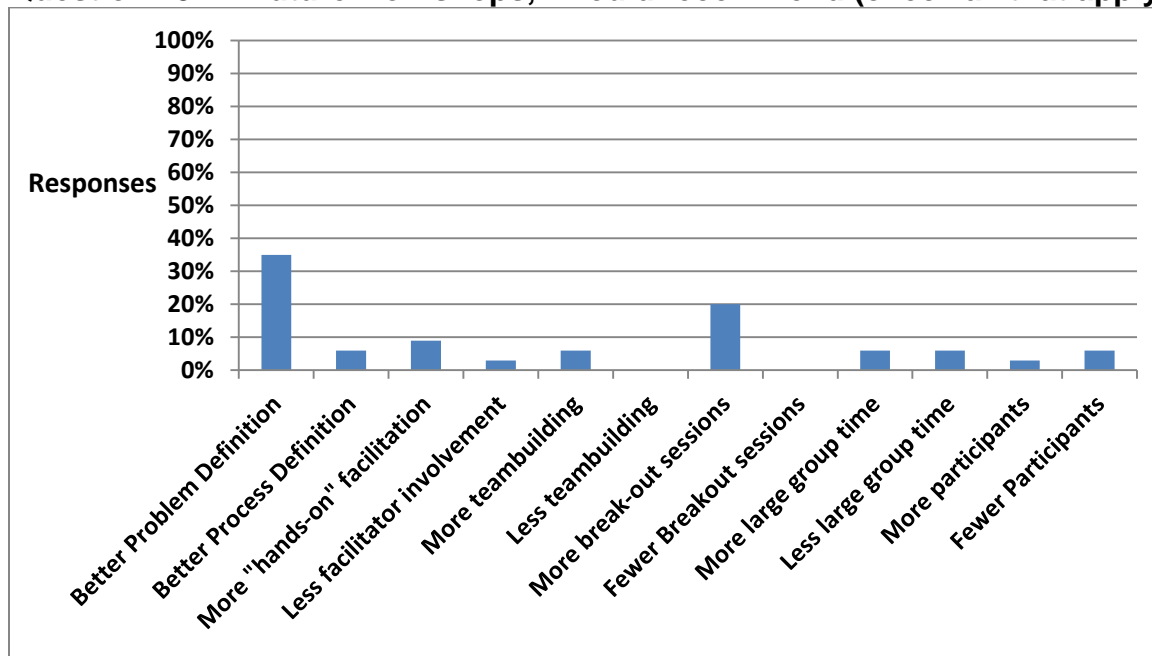
Comments from participants:

- “was expecting to accomplish more, left unable to contribute enough”

Question 27: I would like to participate in similar projects in the future.



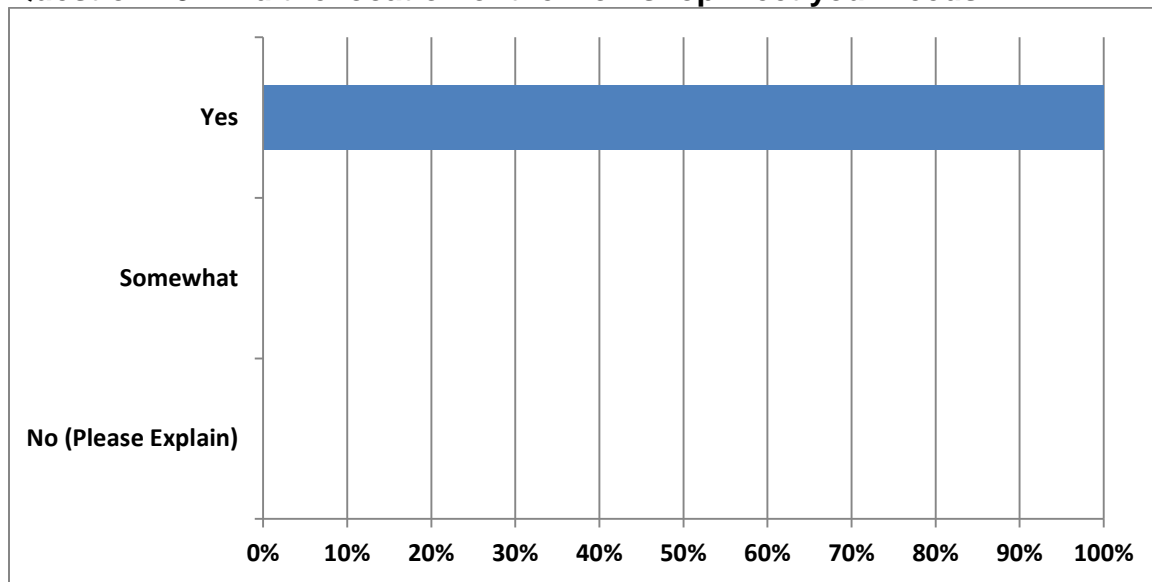
Question 28: In future workshops, I would recommend (check all that apply):



Comments from participants:

- "!!!"
- "Gauge amount of teamwork necessary"
- "longer discussion"

Question 29: Did the location of the workshop meet your needs?



Comments from participants:

- “cold though”

Question 30: What activities did you like most/least?

Which activities did you like most/least?

Participant Comments:

MOST

- “Diverge/converge...the activities where we could list the random things that came to mind.
- “Brief out”
- “Breakouts”
- “Liked the zoom activity; valued the discussions”
- “Breakouts, Converge”
- “Break out session – coming back together as a larger group”
- “Introduction, network, getting to know participants, breakouts, Bart’s recap of the 1.5 days”
- “The homework discussion; Kris’ slide presentation at the end of day 1”
- “I liked the breakout sessions most”

LEAST

- “The AFRL problem activity seemed very specific but unclear as to what specificity the subject was.”
- “What I liked least was not having access to the big picture and allowing each team member to decide what the problem is. Not having a clear definition of what the “perceived” problem is and allowing us to ascertain what the “real” problem may be”
- “Would have much preferred a little more discussion of the actual problem and its requirements and constraints. Allow the teams to decide what the real problem is from each of their perspectives! Do not assume we will be biased because we

know how the problem was solved in the past. Let us understand the entire problem from the highest possible level and then allow us to expand and explore the boundaries.”

- “Defining human-machine-teaming as a group”
- “Defining Human-Machine teaming. I’m not sure we ever came up with an answer. I could guess we might have several different answers in our group.”
- “Connecting by yarn, introducing each other instead of ourselves”
- “String thing”
- “Did not dislike anything. Need to get to know each other to feel comfortable with each other is important for many people.”

POC Comments:

- “Least favorite activity was the String Exercise – not certain we really got how people were connected – that understanding didn’t really occur until analogous activity discussion on Day 2.”

Question 31: What was your overall impression of the Divergent CollaborationSM Workshop?

Participant Comments

- “It was very interesting meeting and working with completely different people. It was pretty confusing and I think working with that confusion was part of the process and challenge.”
- “Outstanding experience. I believe I got more out of this than you!”
- “Good, but slightly incoherent; the facilitators had difficulty conveying a coherent and consistent problem-space and goals for the groups.”
- “It was very interesting. I think people were different but am not sure that there was a lot of “divergent” thinking. Thought we might get to offer more unique outside the box thinking. But I think this would require a different type of early workshop training.”
- “Useful for topics where expertise or maturity of area leads to limited/insular thinking.”
- “Bright, thoughtful participants and skilled facilitators.”
- “It was hard to stay in the problem space for several reasons: 1. There were many problem solvers in the group, 2. We were not sure what the problem was. We were trying to define problems for ??”
- “Interesting concepts presented. Overall some of the best group workshops/discussions I’ve been involved with.”
- “I think the process is very beneficial, but it may require participants to complete more than one workshop to be more effective and feel more comfortable with the process and to be a bit more collaborative.”
- “It was much better than I expected. The information and dynamics created by the mixed group leveraged knowledge.”

- “I learned much more than what ever did about...not only UAV’s...but also how complicated the process of working with the governments entity can be...since this was my first opportunity to participate in such a session.”
- “I think it was somewhat self-fulfilling. Looking for more weeds...not more weed-whacking.”
- “I liked the idea of not completely specifying the problem initially and creating some anxiety for some team members (especially me), however, I felt we needed a clearer description of the actual/perceived problem. I totally agree with the idea of having very diverse groups of thinkers/participants. Loved the teambuilding exercises, however, I would have gone one step further wrt taking the group to an extremely absurd exercise (e.g., at our last MIT meeting we had subject-matter-experts, faculty and MIT grad/undergrad students perform a flashmob at noon in the MIT Student Center of a Haka (<http://www.youtube.com/watch?v=c-lrE2JcO44> as soon as we have the MIT version I will forward if you like). I think you definitely have a process which has worked for you in the past and which is based upon many years of creating teams and solving very complex problems, however, I felt that this workshop was focused on only one specific phase of that process and we were not supposed to have access to and/or participate in the full/complete process. I believe that was what caused the most anxiety for me.”

POC Comments:

- “I’m not certain that this topic was suited for this type of workshop.”

Question 32: What changes could we make to improve future projects?

Participant Comments:

- “Too much emphasis was placed on specific machines and a seemingly specific problem—but then we were told not to think about the problem. Maybe asking each person to think about a problem/solution that they have encountered in his/her own occupation—and then draw aspects from those descriptions instead of talking about a problem and asking how your experience relates to it...”
- “None. Facilitators were outstanding!!”
- “Facilitators need a better understanding or better means of conveying what they want. I don’t know how precisely but have a few thoughts. It’s almost as if you needed a workshop to define this workshop?”
- “You gave one exercise to make the team work together. Think about using exercises related to paradigm shift. Thinking outside the box types of exercises.”
- “Workshop topic perhaps needs to be expressed as a question and not as a theme.”

- “Be more assertive in facilitating group discussions to ensure input by all and less dominance by a few. Provide directory of participants’ contact info.”
- “More clearly define what you are trying to get out of the workshop.”
- “Better define the problem or purpose of the workshop. This would be especially helpful for the homework part. People seemed to be prepared for the wrong thing when they showed up in the morning.”
- “I understand why the “problems” were not detailed initially but greater context—and who was involved with the problem from the group would have been helpful.”
- “Not much, I have nothing else to compare it with.”
- “It would be interesting to bring similar groups together, side-by-side, on the same well defined problem. One group using Divergent CollaborationSM and one using a “solve-this!” method. Charlie and I were dying to attack the problem ☺.”
- “Add one or two more days, include several sessions to immerse the team into what the “actual”/”perceived” problem is that you are trying to solve (just saying manpower/money is the issue and a very brief idea of what the problem is (RPAs surveilling/attacking/targeting/flying, etc.) was not enough in my opinion. Perhaps add some type of simulation capability for participants to immerse themselves in a game which simulates the actual problem/activity. I would have loved to fly a simulated mission. Which reminds me, we were never told what an actual mission(s) was!”
- “Really did not like Scott’s answer which implied that we should not worry about the technical details because we have some really good technical folks already solving that part of the problem. I would say this was the greatest turnoff for me and something which I have experienced personally totally impedes solutions to problems. It is that kind of arrogance (not on Scott’s part) which allowed two Shuttle accidents to occur and which could have prevented several of the teams I worked with from developing the innovations we eventually flew. I never believe the “experts” know anything completely and am constantly pushing for verification and asking my teams to explore the impossible. Not allowing the diverse team to explore every aspect of the problem not only sends a message that their input is not valued (or would not help to creatively solve part of the problem) but that they have to limit their ideas to a much smaller section of the problem without understanding the complete picture and how their ideas could interact with other aspects of the system.”

POC Comments:

- “Probably would spend more time up front with topic sponsor/owner to better understand workshop as well as to better prepare scoping of “the problem.”

Question 33: Comments and/or Suggestions.

Participant Comments:

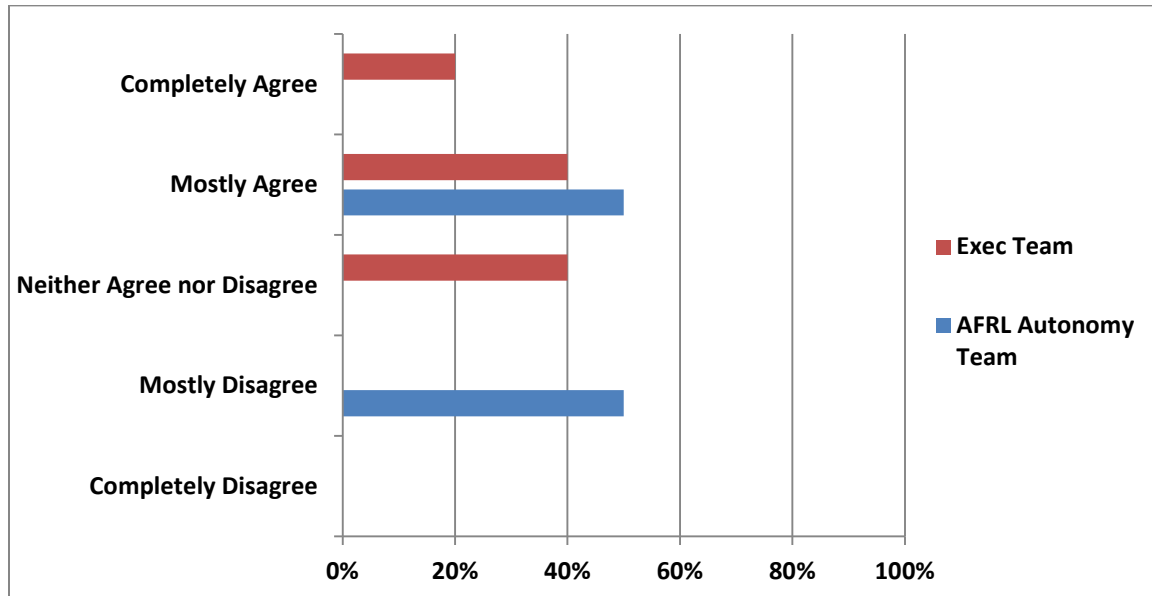
- “Really liked small group work.”
- “See me over a beer. Ideas flow better.”
- “Presentation by Kris should either be more extensive or scrapped. Just confused people who weren’t familiar with the problems facing RPA.”
- “I enjoyed participating and I hope that I was able to help out in just a small way. I really enjoyed being with all the participants and have a great deal of respect for what the project team was trying to accomplish.”
- “Thank you. ☺”
- “I think I exhausted most of my ideas above; however, I would like to add the inclusion of some type of virtual platform for collaboration by which team members could continue to discuss ideas, learn more details of the problem and perhaps help influence a new direction of thought, concept, etc.”

POC Comments:

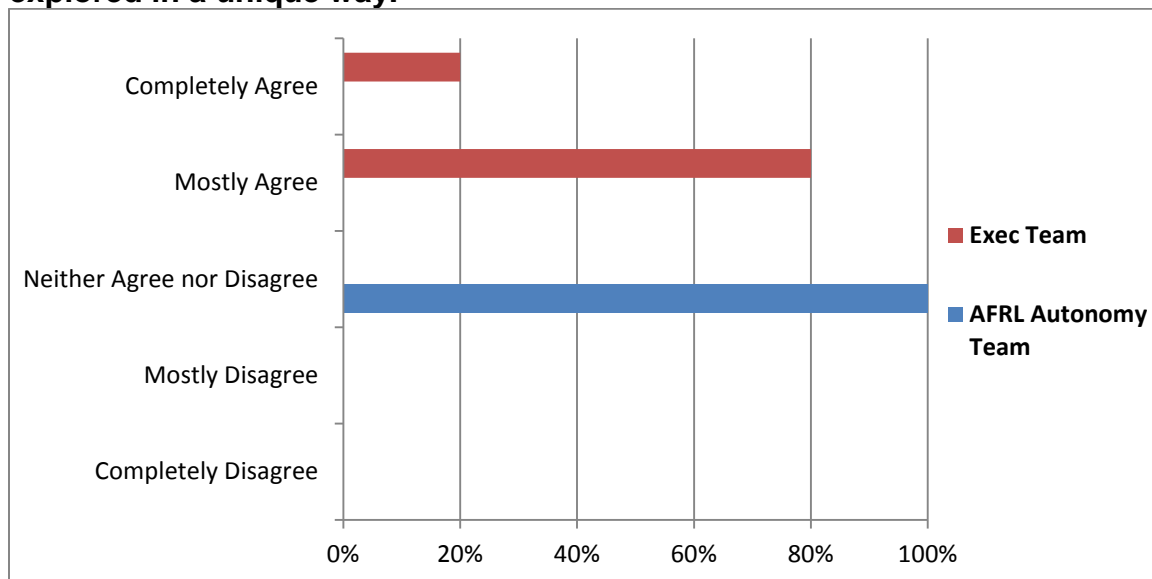
None

7.14. Appendix N – Summary of Autonomy Product Questionnaires

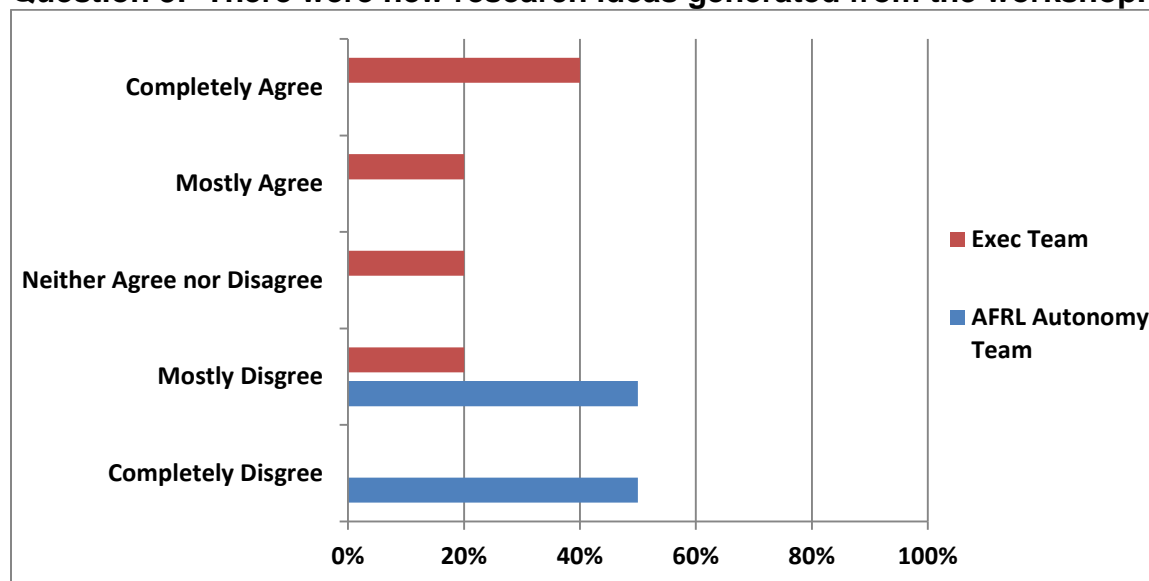
Question 1: The Workshop helped me generate new insights into the Autonomy challenge.



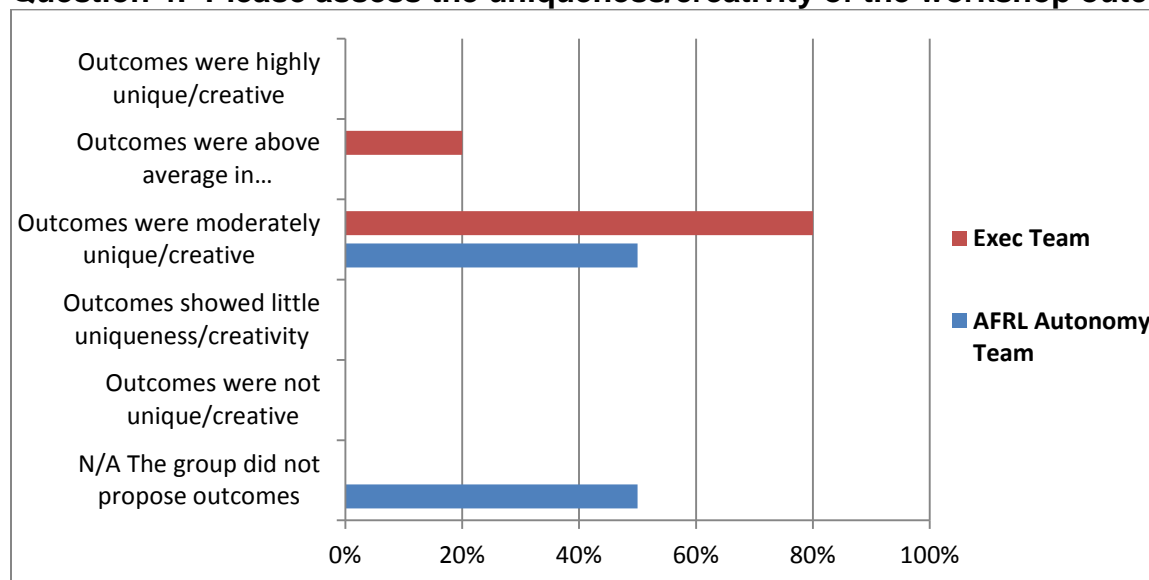
Question 2: At one or more points during the workshop, the problem space was explored in a unique way.



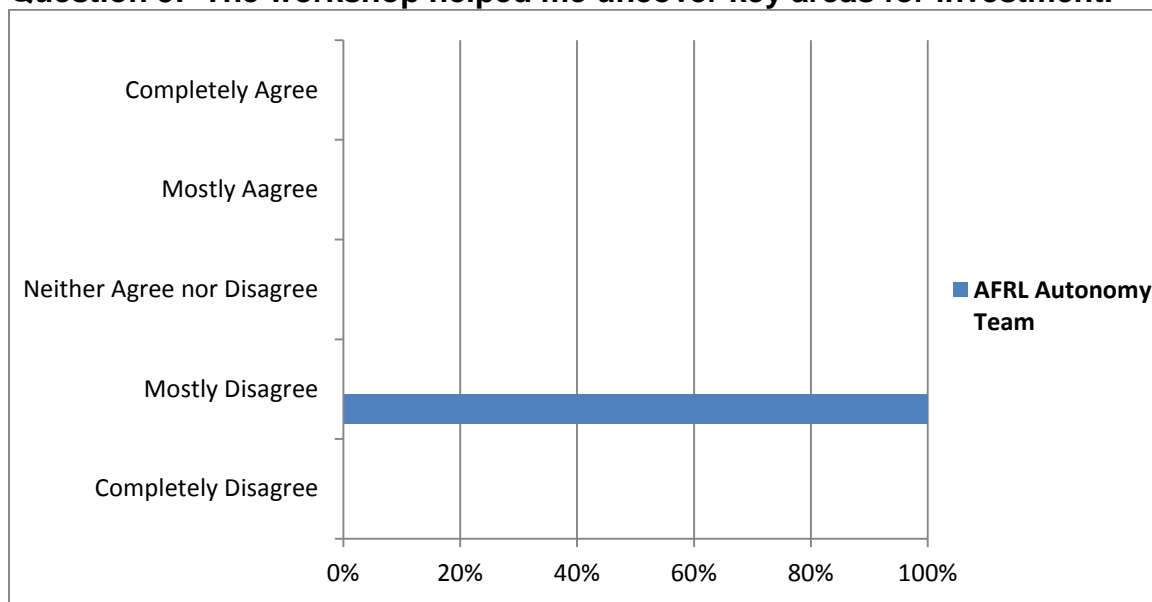
Question 3: There were new research ideas generated from the workshop.



Question 4: Please assess the uniqueness/creativity of the workshop outcomes.

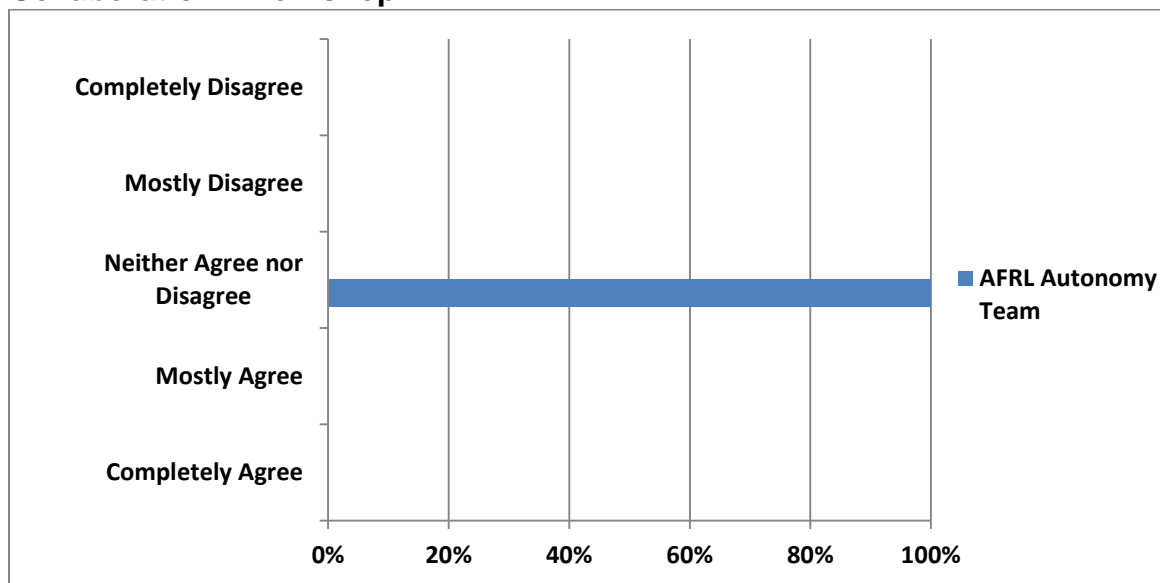


Question 5: The workshop helped me uncover key areas for investment.



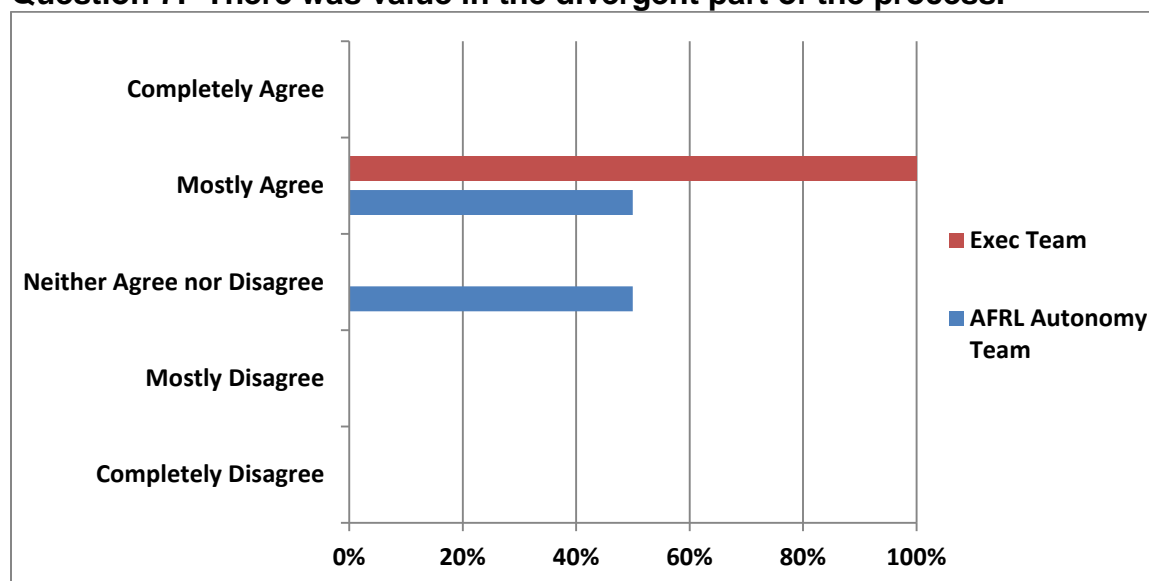
Note: Only the AFRL Autonomy Team filled out this question because it was non-applicable to the Executive Team.

Question 6: I could have achieved the same or similar results without the Divergent CollaborationSM Workshop.

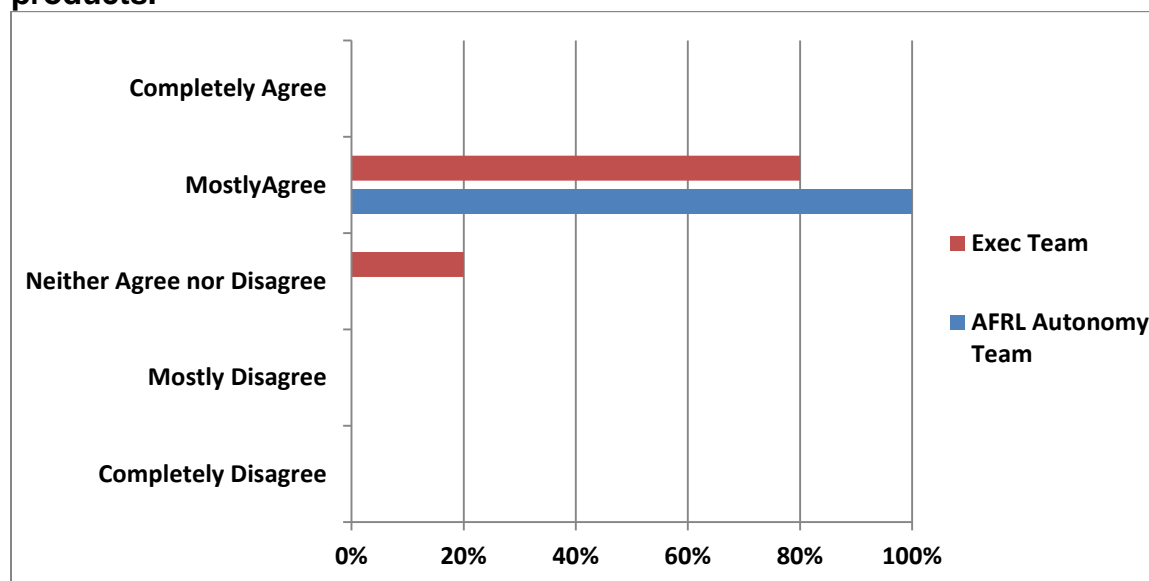


Note: Only the AFRL Autonomy Team filled out this question because it was non-applicable to the Executive Team.

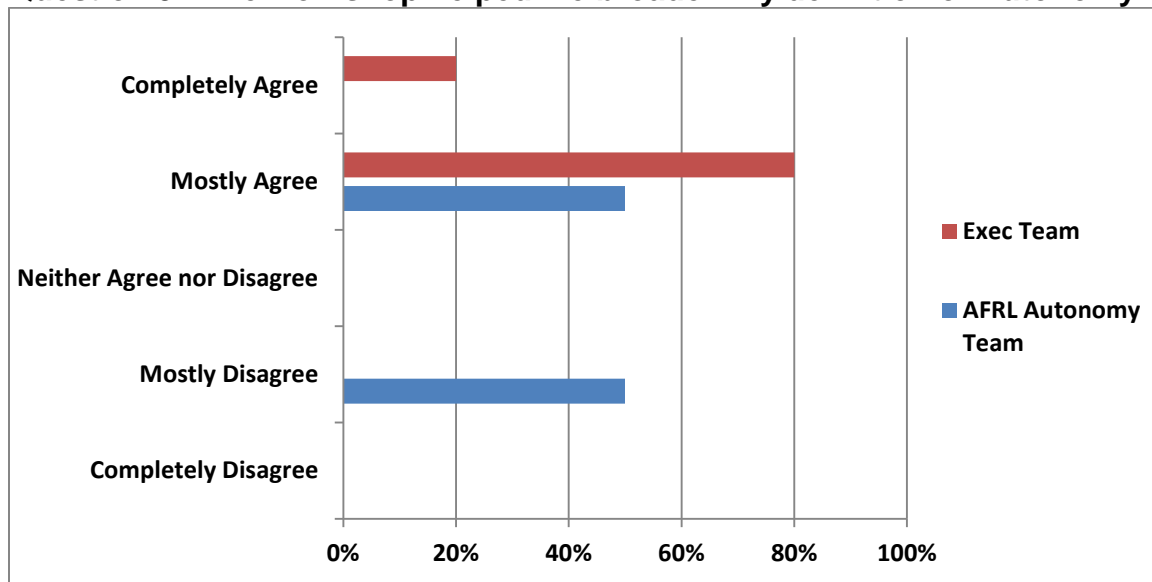
Question 7: There was value in the divergent part of the process.



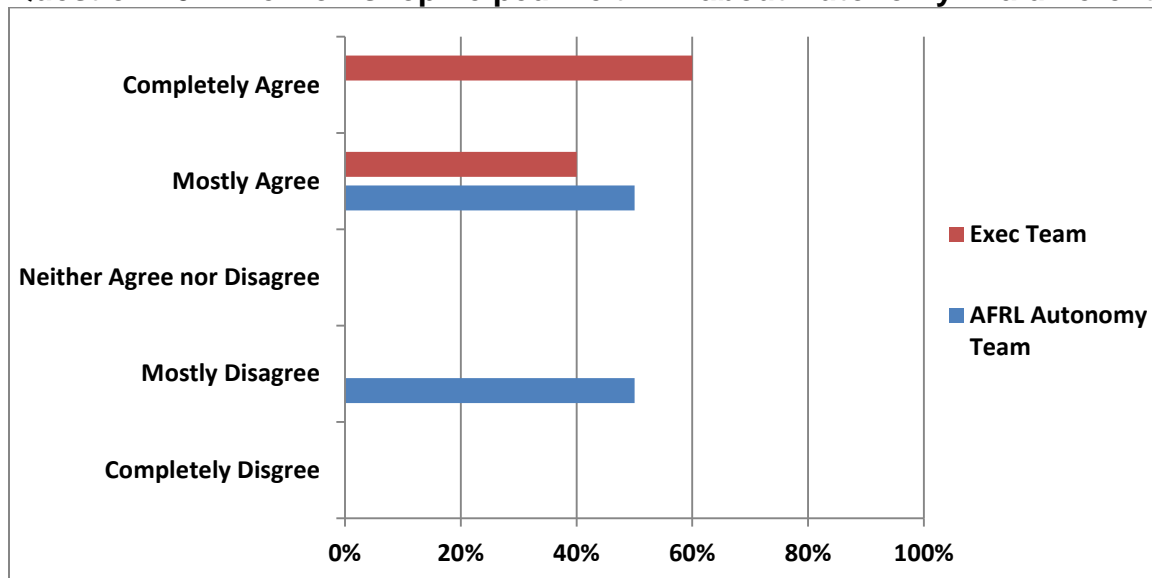
Question 8: The divergent part of the workshop impacted the innovativeness of the products.



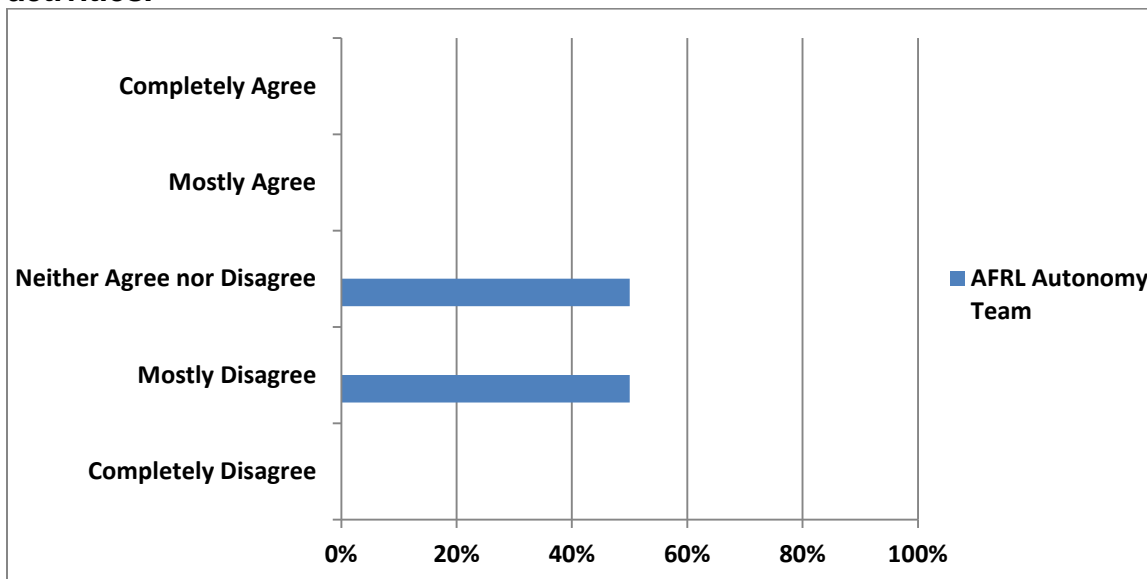
Question 9: The workshop helped me broaden my definition of Autonomy.



Question 10: The workshop helped me think about Autonomy in a different way.

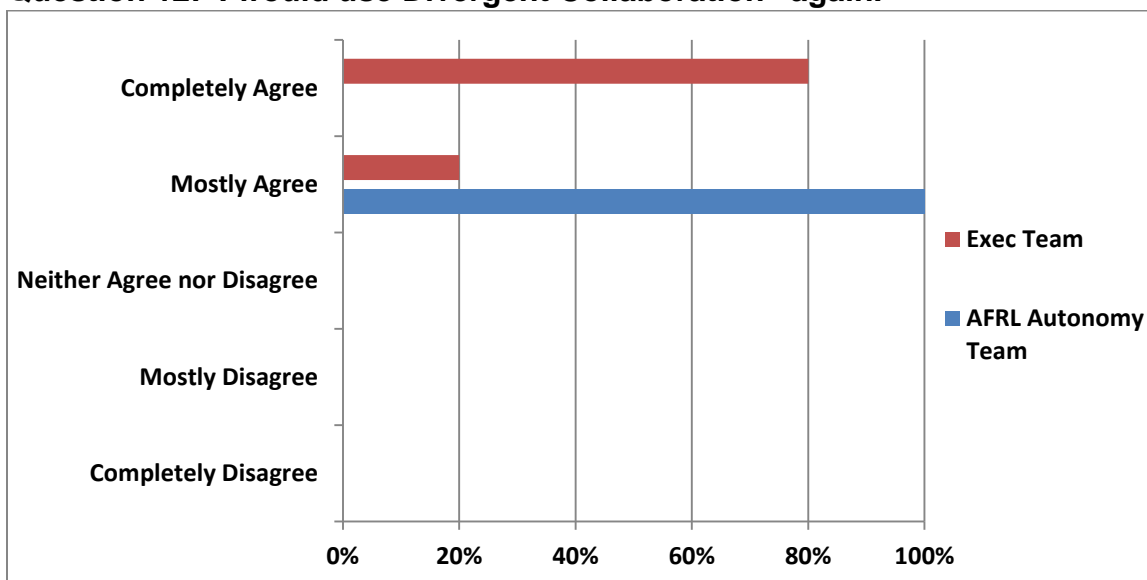


Question 11: The workshop results will impact my future or existing research activities.

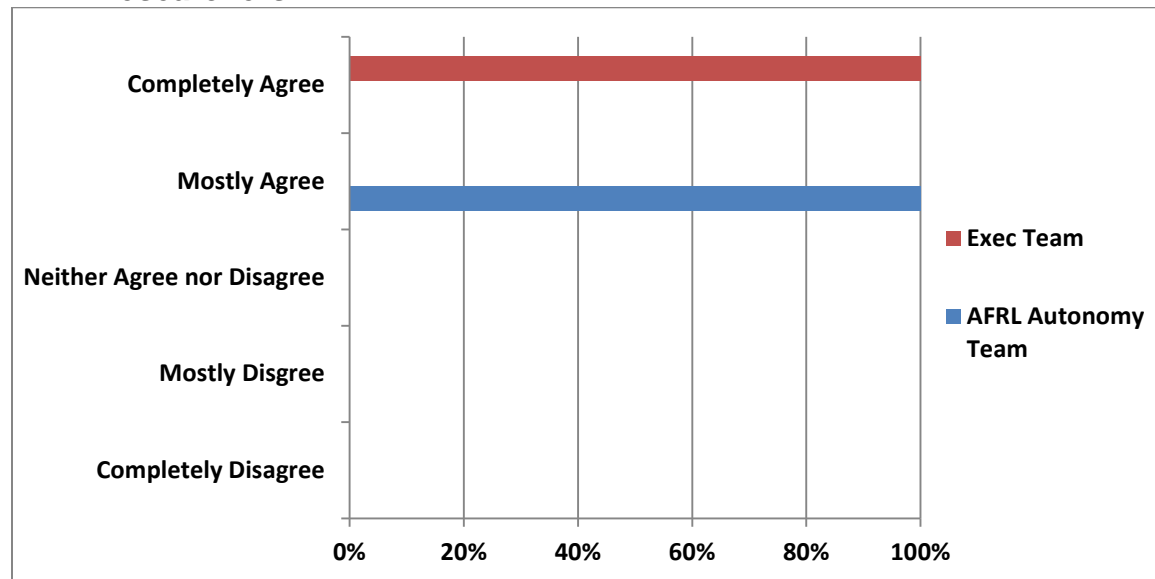


Note: Only the AFRL Autonomy Team filled out this question because it was non-applicable to the Executive Team.

Question 12: I would use Divergent CollaborationSM again.



Question 13: I would recommend a Divergent CollaborationSM workshop to other AFRL researchers.



Question 14: What was your overall impression of the Divergent CollaborationSM Workshop?

Comments from Exec Team:

- "Good but needs to be tailored"
- "Autonomy was too much for the participants to handle so they chose their own specific problem area within autonomy. This allowed them to their attention on something specific. This did not necessarily line up with the POC's problem. Also, the POC's talk seemed way too technical for the participants."
- "Participants thought POC wanted them to solve manning issue rather than explore possibilities."

Comments from HPA Team:

- "The workshop, itself, is a very interesting approach. I think either the topic of human/systems teaming for Autonomous systems is too broad or possibly the activities could have been directed differently to improve the group's productivity."
- "Probably more useful for a mature or otherwise "stovepiped" area where ideas may be stagnating."

Question 15: What changes could we make to improve future workshops?

Comments from Exec Team:

- "Look at each DC uniquely and develop appropriate processes (not just workshop) for each"
- "Have a definite challenge area"
- "Fewer engineers for such technical issues"
- "More break out groups"
- "more informed POC (regarding process)"

Comments from HPA Team:

- "I'm not certain that the group needed to do the string exercise. Everyone came ready to engage so I'm not certain it added anything. Possibly spending more time prior to the workshop to really understand and develop the problem statement. Use more prop work to help frame the problem owner's briefing at the end of the day."

Question 16: Comments and/or Suggestions?

Comments from Exec Team:

None

Comments from HPA Team:

None

7.15. Appendix O – List of Acronyms

AFRL	Air Force Research Laboratory
DC	Divergent Collaboration
DiSC	Dominance, Influence, Steadiness, and Compliance
HPA	Human Performance Augmentation
IDEA	Innovate, Demonstrate, Explore, Apply
RH	Human Effectiveness Directorate
RY	Sensors Directorate
S&Es	scientists and engineers
STEM	Science, Technology, Engineering, and Mathematics
WBI	Wright Brothers Institute